J. Nelson Spaeth.

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JOURNAL *of* FORESTRY

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THE LUMBER INDUSTRY TAKES THE CURE

EDITORIAL

One of our greatest industries—the lumber industry—has been ill for a long time. Many have even given up hope for its recovery. The diagnosis as to the character of its ailment differed widely with the point of view of the diagnostician. The foresters made their diagnosis. The financiers in the industry thought that they knew what was ailing it. The rank and file in the industry had their opinions. The most encouraging thing that has happened in a long while is that the patient is throwing to the wind the advices of his many physicians, grabbing hold of himself, and making up his mind to get well at any cost. His spirits have already brightened and he shows signs of rallying. As with humans, a cure for deep-seated ills can follow only, when the patient helps with a will of his own. This "will" the lumber industry is expressing in an ambitious campaign for trade extension. Some $3,000,000 are to be spent each year for this work. The National Lumber Manufacturers' Association has embarked upon a campaign to promote the use of wood in general, involving an annual expenditure of a million dollars. The West Coast Lumber Trade Extension Bureau is spending $500,000 each year in the promotion of Douglas fir and associated species. The Western Pine Manufacturers' Association is backing its product with an expenditure of over $100,000 a year, and the Redwood people are keeping pace. The Southern Pine Manufacturers are spending also large sums, and several smaller regional groups and individual companies swell the total to nearly $3,000,000. The California Pine group, although temporarily dormant, will undoubtedly soon be in the field with a program of its own.

Any trade extension campaign very naturally has a selfish motive—the promotion of trade in certain materials. However selfish it may be, it can be made to elevate the standards of the industry to higher

levels of business conduct, develop a greater public appreciation for wood, with the result that both the public and the industry may be the beneficiaries of such a movement. But if trade extension is expected to bring about higher prices for and greater use of lumber by high pressure methods based only on persuasive speech and colorful advertisements, it is doomed to failure at the start. The public is awakening to much of the "bunk" that is fed to it in advertisements. If the movement is to succeed, and we sincerely wish it success, there must be honesty of purpose and substance to it. Two things in our opinion must underlie a campaign for trade extension.

First of all the product must be studied. Field agents for lumber associations not so many years ago, were seriously handicapped in promoting the use of wood because they felt there was so little to say about it. Much information is now available as to the qualities of wood, so far discovered and assembled largely by public agencies. This information can now be readily worked into advertising copy and sales talk. There is no longer any excuse for want of truthful and convincing sales arguments. Our knowledge of the wood, however, should not stop here. New facts must be discovered and new fields need to be conquered. Another handicap of the early field agents was the inability or unwillingness of sawmill operators to furnish what their trade extension departments promised. This, however, is gradually being overcome. Trade extension has been responsible for many improvements in the methods of manufacture and merchandising. These improvements should be continued still further. Whatever abuses there are should be corrected and useless traditions abandoned. Without such improvements, efforts under the guise of trade extension will be merely wasted energy. A sane trade extension movement should not merely disseminate true information and develop a higher regard for wood, but should backfire into the industry itself and point out weaknesses in it that need attention.

The *second* essential condition for the success of the movement is faith in the future of our forests. Unless the industry can convince the public that the perpetuation of the forest is as much its concern as the sale of the product, the campaign will not make much headway. No one wishes to buy a product, even if it is good, if it is manufactured under unsanitary conditions and without regard for the welfare of the workers in the industry. No one will be enthusiastic to use wood, if it is bought at the sacrifice of the forest and regardless of the future use of the land. There is no need of developing permanent habits of

wood use, if the supply of timber is to be short-lived. The lumber industry has a wonderful opportunity to put into use a product infinite in its uses and unsurpassed in its qualities—a real boon to human civilization. At the same time it can regain the public confidence that as a trustee of the largest, finest, and the best part of the forest wealth of the country it is not going to abuse this trust but handle it with care, knowledge, and skill. If the industry can rise to this occasion foresters will not be found standing aloof in the pose of sceptical onlookers. They will take a spirited and helpful interest in making this big effort of the American lumber industry a real success.

LOUIS AGASSIZ FUERTES

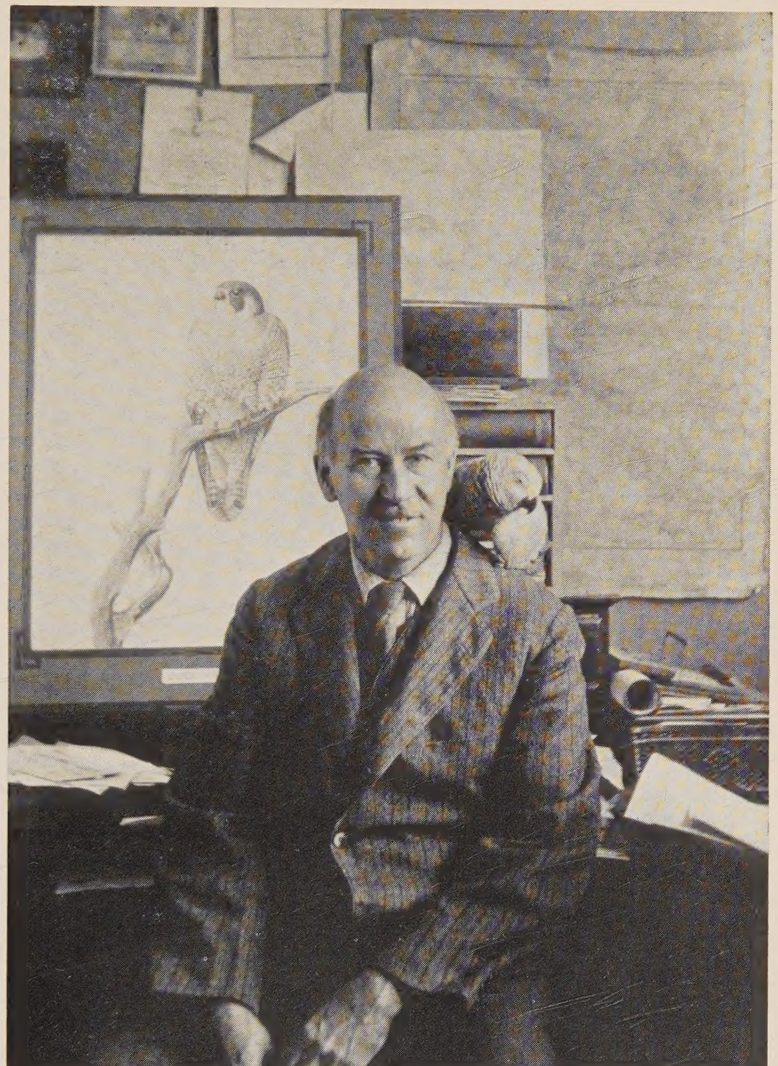
1874-1927

The sudden and untimely death of Louis Agassiz Fuertes on August 22, 1927, in an automobile accident at Unadilla, New York, brought sorrow to a host of persons in the United States. As a painter of birds and small animals Mr. Fuertes was recognized internationally as of outstanding eminence. His passing is felt as a personal loss to many who knew him only through his work. To those who had the privilege of his acquaintance and friendship his death brings poignant grief. To them the memory of his genial personality, his quick wit and his whole hearted interest in all with whom he came in contact will ever remain a treasured possession.

Louis Fuertes' reputation rests on his skill in the portrayal of bird life and in his contributions to ornithology. But he was as well an all round naturalist who was at home in many of the branches of applied science. Among these his interest in the forest led to his election as an Associate Member of the Society of American Foresters in 1919.

Louis Agassiz Fuertes was born in Ithaca, New York, February 7, 1874. He was the son of Estevan Antonio and Mary Stone Perry Fuertes; his father being dean of civil engineering in Cornell University. Louis Fuertes was graduated from Cornell in 1897 with the degree Bachelor of Science. In 1922 he was appointed lecturer in ornithology at Cornell, his only other official connection with the University. He was married in 1904 to Miss Margaret F. Sumner, of Ithaca. There are two children, a son and a daughter.

Mr. Fuertes made his home in Ithaca, but in connection with several scientific exploring expeditions of which he was a member, he visited many parts of the world and made collections of the fauna of numerous localities before unknown to science. One of these trips led him up the Amazon and into the mountains of South America. He had just returned in June from Abyssinia, where as ornithologist of an expedition sent out jointly by the Field Museum and the Chicago *Daily News,* he was one of the first white men to penetrate the interior of that country. At the time of his death he was at work on a book describing the results of that expedition of which he was both author and illustrator.



Louis Agassiz Fuertes

From 1896 on, Louis A. Fuertes had been illustrating books on birds. Some of the more important in this long series are as follows: Bailey's *Birding on a Broncho,* 1896; *Song Birds and Water Fowl,* 1897; Coues' *Key to North American Birds,* 1903; Bailey's *Handbooks of the Birds of Western* (1902) and of Chapman's on *Eastern United States* (1904); a series of bird and animal pictures in the National Geographic Magazine, 1914-19; besides plates in the report of the New York State Forest, Fish and Game Commission, 1903, the New York State Museum Memoir, Eaton's *Birds of New York,* and in the publications of the American Museum of Natural History. His latest important work was to illustrate Forbushe's *The Birds of Massachusetts and the other New England States,* the second volume of which is still in press.

Fuertes assisted in designing part of the habitat bird groups in the American Museum of Natural History in New York City which are characterized in the *New International Encyclopædia* as "one of the most attractive features of the institution." He executed paintings for the New York Zoölogical Society. His colorful murals of the birds that gave the name to the Flamingo Hotel at Miami, Florida, were the result of a special expedition to the West Indies. Others of his paintings are panels for various individuals, including one series of twenty-five for Mr. F. F. Brewster, of New Haven, Connecticut.

During the war Mr. Fuertes' intimate knowledge of the protective coloration of birds and mammals was made available to the Federal Government and resulted in many useful suggestions that were put in practice in the art of camouflage, originated by the artist Abbott H. Thayer, and used both on land and sea. Mr. Fuertes' connection with the actual practice of forestry was perhaps not so direct, but from time to time his keen comments on points under discussion in the profession were most helpful to members of the New York Section. He was an associate member of the Society since 1919 until his death. He was well acquainted with the national forests and was also deeply interested in the problems of recreational use both of national forests and national parks. This is attested by his active participation in some of the investigations carried on in the field by the Co-ordinating Committee on National Parks and National Forests. He was active in Boy Scout work and was one of sixteen who have been elected Honorary Scouts by the National Boy Scout Council.

As to the man himself, Louis A. Fuertes has been characterized by the *Cornell Alumni News* as "Cornell's best beloved alumnus." At

gatherings of returning graduates he was always the center of interest. Inimitable as a story teller, he could keep a group rocking with continuous laughter. His "lecture" on the "Classification of Snores" is remembered as a masterpiece of delightful mockery. He was one of those rare men who won and held the respect and affection alike of Boy Scouts and college students and of scientists, professional men and artists, all of whom found in him a kindred spirit. The doors of his studio were ever hospitably open and no one went away empty handed, whether he dropped in merely to exchange stories or for the helpful suggestions that came from him in a serious talk.

Combining as Louis Fuertes did the highest ability in his chosen vocation with a personality that endeared him to everyone, it may truly be said of him that he made the world "happier for his presence." Louis Agassiz Fuertes is one of those who will not be forgotten.

RALPH S. HOSMER
CHAS. C. ADAMS
BARRINGTON MOORE
Committee

THE HUMAN EQUATION IN THE FOREST FIRE PROBLEM

(An Experiment)

By Harris A. Reynolds

Massachusetts Forestry Association

Although the forest has many other enemies, fire is still the most universal, spectacular and destructive of all. It is probably the greatest deterrent to the practice of forestry in this country, and especially to reforestation by planting. When fire sweeps through a mature forest there is usually some opportunity to salvage the dead trees, if the location of the forest is reasonably near a market, but when young unmerchantable trees are burned it means a total loss to the owner. Hence the forest tree planter must run the risk of losing by fire his entire investment in trees and planting for a period of twenty to thirty years, depending upon the species. He can, of course, get partial insurance, but the rates for forest fire insurance are still excessively high on plantations. There are very few states where the forest fire losses are sufficiently low to enable responsible insurance companies to schedule rates that are attractive to the prospective investor in plantations of commercial forests.

The seriousness of the forest fire problem is emphasized by the fact that on the average more than 2 per cent of the forest land of the country is being burned over annually and it requires from 50 to 100 years, depending on the soil, climate and species, to produce a crop of timber of sawlog size. One encouraging feature about this condition is that many areas are burned over repeatedly, with only short periods between fires, and consequently the loss in timber is low in such cases. On the other hand, much timber that is inaccessible today, but which will be needed by our industries within the next two of three decades, is being destroyed by fire. When we realize that we have already entered the period of timber shortage which this country must face, particularly in the northeastern states, the burning of our depleted supply is folly. It is worse than folly because our children must pay for our recklessness, by which we profit nothing. A growing industrial nation can ill afford to squander its natural resources, even when those resources are replaceable as our forests are. World competition is becoming keener with each generation and any increase in the cost of dwelling

construction must either be met by an increase in wages or by a lowering of the standards of living. An increase in wages ordinarily results in a reduction of profits wherever competition is a serious factor. The vast majority of our people live in wooden houses and all dwelling construction calls for wood. When prices for wood for dwellings double and quadruple as they have in many of the Eastern states in recent years someone must pay the resultant increase in rents. Substitutes for wood are being developed, but many of the so-called substitutes are merely wood in some manufactured form. Since wood is a universal commodity, the cost of it will govern the cost of the bona fide substitutes until those substitutes become numerous enough to come into competition with each other. Therefore, the hope of benefiting by substitutes so far as prices are concerned is rather forlorn. The wood that enters into the construction of the ordinary dwelling represents from 15 to 30 per cent of the total cost of that dwelling, and when, because of shortage, the price of wood for this purpose is increased, the rents must be correspondingly higher. The fact that many of the Eastern states are importing 80 per cent or more of their lumber requirements for general construction purposes, means that the industries of those states are handicapped because of the higher rents that must be paid by their employees. Every man, woman and child is affected financially or otherwise by a timber shortage, and the careless burning of timber anywhere in the country is a matter that affects the welfare of all the people. Therefore, forest fire prevention is a national problem of no mean proportions and one that should be of vital interest to every citizen.

Foresters and timberland owners have been working for many years to solve the forest fire problem, but the records of the past few years would indicate that they are still far from the solution. The statistics of one bad fire year constitute a kind of standard to measure our progress in subsequent years, and we are inclined to look upon reductions in losses compared with that year as a sign of increased efficiency in the fire prevention organizations. Then along comes another bad fire season and we fall back to the old record, or exceed it in losses sustained. The record of that year in turn becomes a new measuring stick and so on *ad infinitum*. It is like the frog in the well, climbing up a certain distance each day and sliding back again at night.

Substantial progress has been made in the development of fire fighting equipment, and considerable improvement in methods of detection and suppression must be noted, but the demon still continues to devour

the forest. If we analyze our fire records we find that with the exception of the localities where forest fires are started by lightning, human carelessness in some form is directly or indirectly responsible for practically all of our forest fires. In the Eastern states fully 99 per cent of these fires are man-caused. With this fact before us, would it not appear that we are working from the wrong premise when we spend more money for fire suppression than for preventive measures? Of the millions of dollars appropriated in this country in the past to reduce forest fire losses, the bulk has been spent for the detection and the fighting of fires rather than for prevention.

We have begun to establish forest experiment stations in order to learn how to grow and manage our forests in the most profitable manner, and this is evidence of public awakening to the forest needs of the country. These stations are fundamentally essential to forestry progress. But, what will it profit us to know how to grow timber if it is to be destroyed by fire? Scientific studies have been and are being made to determine the relation of humidity to forest fire hazard, the cost and value of disposing of slash after lumbering, the effect of rot producing fungi and their possible use in hastening the elimination of slash, and many other projects which will prove of value in reducing the fire hazard, but most of them deal with the material rather than the human factor in the problem. Since carelessness is the chief cause of forest fires, it is unquestionably the most important factor in the problem of prevention. It is a human weakness that cannot be dealt with successfully through legislation. There are forms of carelessness that are punishable by law, and when discovered the person carelessly starting a forest fire may be punished, but many of these fires are started by respectable citizens through careless habits, without the slightest knowledge on their part of having done so. The carelessly tossed match and smoking materials are outstanding examples of how these fires occur. Detection of such acts and the interception of the offenders by officers of the law, are, by nature of the case, infrequent and largely accidental. To change the habits of the general public is an almost insuperable task, but it is only through education that this can be done and our efforts so far along that line have been rather feeble when judged by the records of fire losses from year to year.

Of late years, however, more emphasis has been placed on the need of public education as a factor in forest fire prevention and many excellent campaigns have been carried on both in this country and in Canada, in which considerable public and private money has been spent

for this purpose. Forest Fire Prevention Weeks have been proclaimed by the President and the Governors. Hundreds of speeches have been made and thousands of columns on the subject have been printed in our magazines and newspapers. Motion pictures, posters, pamphlets and scores of other agencies have been brought into play to inform the public about this terrible enemy of our forests. But thus far, the value of this educational work has never been established in such a way as to lead to the creation of a system or formula by which an intelligent estimate can be made of the results that may be expected from the expenditure of a given sum for public education, nor to determine the best way to apply it in practice. We do not know whether our educational campaigns are worth ten, fifty or one hundred cents per dollar spent.

An experiment is now in progress in Massachusetts that may possibly throw some light on this subject. An effort is being made to determine the money value of public education and patrol in the prevention of forest fires. The cost of suppression alone and the acreage burned over for a period of years is known for the district in which the experiment is being conducted. Now, it is proposed to combine with the suppression work, under a well prepared plan, public education and patrol, and to compare the records obtained with those for suppression only. If it can be shown that better results may be obtained through the expenditure for prevention of part of the money now used for suppression it will lead to a general reorganization of the forest fire prevention system in that state. That is the main purpose which it is hoped to accomplish by the experiment.

In this experiment there are five co-operating agencies: namely, the United States Forest Service, the Massachusetts Department of Conservation, the Massachusetts Forestry Association, the local fire wardens of the townships covered by the experiment and the inhabitants of those townships. The work is divided among those agencies and the expenditures of each will be accurately kept.

The area selected for the experiment consists of the townships of Bourne, Barnstable, Falmouth, Mashpee, Sandwich and Yarmouth on Cape Cod. This district is recognized as having the highest forest fire hazard to be found in Massachusetts. In fact, it would be difficult to find an equal area in the Eastern states that surpasses it in this regard. The pitch pine and the scrub oak in mixture are the predominant species and both are highly inflammable. Fully 50 per cent of the forest area has been burned over at least once in the past twenty years and some

sections have been swept by fire several times during that period. This means that large tracts are now covered with dead trees and shrubs, interspersed with the young pines and scrub oaks, a combination which is a veritable tinder box during dry periods. High winds occur during every month of the year, and it is not uncommon to have a heavy rainfall one day and forest fires the next. Snowfall is usually light and of short duration, so that forest fires have been recorded in that district every month in the year.

Another reason for choosing this area is the fact that it is practically surrounded by water. There is tide water to the north, south, and west. The Cape Cod Canal, which is part of the boundary, severs the Cape from the mainland and is a perfect fire line, while on the east the Bass River practically cuts the Cape in half. For forest fire prevention purposes this area may be considered an island because any fire occurring on it must have originated there since the possibility of fires spreading into this area from adjoining territory is very remote. This fact eliminates the difficulty of providing against such fires, and of apportioning the losses that may occur.

The topography of this region may be described as rolling, only a few points reaching an elevation of over 200 feet. It is broken in many places by lakes and bogs, and some of these bogs are utilized for the growing of cranberries. Several small tidal rivers extend into the district. Limited sections contain large quantities of boulders, the remains of terminal moraines of the glacial periods. The soil is largely sand or sandy loam. According to the soil survey of the United States Department of Agriculture, most of the area is chiefly suited for tree growth.

From the forestry standpoint this district once produced large quantities of timber and the abundance of old logging roads is mute evidence of a period when a better forest type existed there. Occasionally a sheltered spot is found where large white pines about 100 years old are still standing. There are several young plantations of white, red and scotch pine that compare favorably with plantations of equal age in other sections of the state. Norway spruce plantations of recent years are making a fair showing and old trees of that species used for ornamental purposes have made a good growth. The State Department of Conservation has a thriving nursery in the district, and a state forest of over 8,000 acres. Two of the towns have established town forests and have planted several thousand young trees. As a rule the present natural growth is of little commercial value, and by itself would hardly be worth the cost of protection against fire, but in order to re-establish

a commercial forest in this district the humus and the soil must be protected, and the fire losses reduced to the point where reforestation will be practiced generally. Since this region is the playground for hundreds of thousands of people and will always be used for that purpose, the esthetic value of the forest far outweighs its timber value. For this reason alone even the present forest is worth protecting.

Since more than 90 per cent of the permanent population live in the towns and villages by the seashore, the best roads are along the shore, although four good roads cross the district. A railroad traverses the area east and west, with two branch lines running north and south. Many public and woods roads have been abandoned since the coming of the automobile so that comparatively large areas without a passable road through them were not uncommon when this experiment was started. The forest growth is so scrubby that formerly serious attempts were seldom made to protect it, and fire fighting had become largely a matter of saving buildings and other valuable property. Until recent years back-fires were the chief weapon used for combatting forest fires and these frequently got out of control. Fire was largely responsible for the steady deterioration of the growth on the greater part of the area. Before this experiment was initiated forest fires were taken as a matter of course by the general public and this attitude was reflected in the small annual appropriations made by town meetings for fire fighting equipment and for suppression. As a result the local forest wardens found great difficulty in perfecting adequate organizations to cope with the fire problem.

The permanent population of these six townships is about 15,000, but it is estimated that the summer residents and tourists increase the population during the summer months to about 100,000. Most of the people are descendants of the early settlers. The township of Mashpee, however, is the old Mashpee Indian Reservation. This reservation was a terminal of the underground railroad before the Civil War and intermarriage between the two races was not uncommon. Very few white people are to be found among the present inhabitants. The township of Falmouth contains a colony of Portuguese, which constitutes over half of the permanent population. These people came to this country largely by way of the West Indies and other southern islands and they show the results of contact with the natives of those islands. Many of them do not speak English and this fact complicates the educational work.

Throughout this district the blueberry grows in abundance and since this shrub survives the ordinary forest fire and is believed to bear more profusely for a few years after a fire occurs, it has been credited in the past with being one of the chief causes of forest fires. The Portuguese have large families and as every child old enough to pick berries can be employed they have found the blueberry crop a profitable means of livelihood. Besides, the owners of much of this wild land are non-residents and they, as well as many of the local owners previous to the beginning of the experiment, showed little or no interest in protecting the forest from fire. These conditions tended to encourage periodical burning of the favorite blueberry districts.

The total area in these six townships, or towns, as they are called in New England, is 157,000 acres, of which about 110,000 acres are covered with some sore of forest growth. The interior of the district is practically given over to the forest except for an occasional hamlet or small farm. The state maintains two fire look-out towers within the district and a third, located just outside of it, serves a part of the experimental area. Besides the woodland there are large tracts of marsh land and old fields near the villages and the grass fires occurring on them frequently reach the woodland before they can be extinguished. Therefore, these lands must be protected from fire the same as if they were woodland.

The plan of conducting this experiment originated with the Massachusetts Forestry Association and through its efforts representatives of the United States Forest Service, the State Department of Conservation and the local forest wardens of these six towns were brought into conference. Details were worked out under which the Federal Government would contribute $2,000 for the first year from the co-operative forest fire funds, provided under the Clarke-McNary Act, and this was to be matched by the state through a special act of the legislature, the $4,000 to be used for the employment of two forest rangers to patrol the district during the fire season under the direction of the state forester. The association was to have charge of the educational work, the cost of which was estimated at $4,000 for the first year. The local wardens were to continue in charge of the work of fire suppression as in the past, and the towns were to be requested to make appropriations for special projects that might be proposed. The experiment was to cover a period of three years in order that at least one bad fire year would be included.

Since the establishment of the office of state fire warden in 1911, records have been kept of the fire losses, acreage burned and the cost of suppression in each town. The figures from the town records show that the average annual cost of forest fire suppression in these six towns for the past three years aggregate $9,829, which is about nine cents per acre for the total woodland area. The average acreage burned over annually was 9,363, or about 8½ per cent of all the forest land. This period included one bad fire year. Since the value of the merchantable wood or timber on this land is insignificant it has been decided to base the calculations for the purposes of this experiment, only on the relative costs and acreage burned before and during the experiment. Accurate account is to be kept of the costs of the educational work, the patrol and the suppression for the three years. The total cost of these three activities and the acreage burned during the three year period will then be compared with the total cost of suppression and the acreage burned during the three years prior to the beginning of the experiment. It is assumed that the standard of efficiency of the local fire fighting organizations will be as high during the experiment as before, and there is every reason to believe that it will be higher because of the general increase in public interest, due to the educational work and the enthusiasm of the local wardens to make the experiment a success. Therefore, any reduction in costs or in area burned over during the experimental period when compared with the previous three years may fairly be credited to the educational and the patrol work, and will be the measure of its value.

The experiment is to cover the calendar years 1926 to 1928, inclusive, and the educational work was begun by the Massachusetts Forestry Association on the first of January, this year. Its forester, equipped with motion pictures, bulletins describing the experiment and setting forth methods of fire prevention, posters and other educational material, spent three months in the district giving talks to all the schools, boards of trade, women's clubs, fraternal organizations, civic associations, church clubs and similar groups, in fact to every kind of gathering where the showing of the pictures was possible. Conferences with individuals and small groups were held in every community. By the end of the three months, practically every man, woman and child in the district knew about the experiment, and what each could do to help. The press devoted much space to the experiment and the railroads, electric power companies and manufacturers pledged their hearty co-operation. As a climax to the work of the association's forester, the lecturer

of the United States Forest Service spent a week in the district giving special talks to selected groups. A personal letter requesting co-operation was written to every property owner, resident and non-resident alike. Signs six by eight feet, printed in large red and black letters, warning the public that the roads were patrolled and to throw no smoking materials from their cars, were conspicuously placed at the four main entrances to the area. Bulletins were distributed and lectures were given so far as possible in adjoining districts, in order that the people who frequent this area might be informed of the experiment.

As a part of the educational campaign a study was made of the woodlands to determine how the work of the fire wardens could be made more effective. It was found that many areas ranging from 1,000 to 4,000 acres contained no roads passable for vehicles of any kind and a fire starting in the interior of one of these tracts could not be reached with fire apparatus until it had burned almost to the nearest road. The rapidity with which fire usually travels through the scrub oak and pitch pine renders any attempts to reach it through the tangle of undergrowth almost suicidal. A sudden shift in direction by the wind might entrap the men on the side lines of the fire. Although the scrub oak seldom exceeds a height of six to eight feet, many pitch pines of varying ages are scattered among the oaks so that only a few minutes need elapse after a fire is started under favorable circumstances until it becomes a crown fire. Under such conditions only the most powerful apparatus or a back-fire can stop its advance. The only hope, therefore, of reducing the fire hazard in such districts was to cut these tracts into smaller areas by brushing out the old roads so that the fire fighters could reach a fire in its incipient stage. No matter how efficient a fire department may be or how modern its equipment, if it cannot reach a fire quickly under the conditions that prevail in that section its effectiveness is greatly reduced. It was agreed after consultation with the forest wardens that an area half a mile square could be protected with their present equipment because a fire starting anywhere in such a tract could ordinarily be reached before it got beyond control. And so it was decided to remove the brush from enough old public and logging roads to cut these large tracts into smaller ones averaging about 160 acres in area. Each town was scouted and the approximate number of miles of such roads was determined. The average cost of this work was estimated at $25 per mile. The total estimated mileage to be brushed out in the six towns was 176, and the estimated cost $4,400. The Massachusetts Forestry Association then offered to bear

half of the cost of this work in each town if the town itself would appropriate the other half. Because of the educational work that had been done, each town at its annual meeting appropriated from $200 to $500, making up the $2,200, and the association in turn raised the other $2,200. This was done by private subscriptions largely from property owners within the district. It should be noted that these funds are not considered a part of the cost of the experiment because they represent a result of the educational work. They could not and would not have been raised had it not been for the educational compaign.

Only about three-fourths of this money has been spent because some of the towns were unable to get the work done before the fire season was so far advanced that the burning of brush could not be done with safety. A little over 120 miles of road have been opened and the actual average cost per mile is slightly less than $30. However, these roads have already proved their value on several occasions. In one instance a fire started on a windy day near the center of what was formerly one of these large tracts. The local forest warden was able to drive his fire apparatus over one of these newly brushed out roads to within 200 feet of the head of the fire and it was extinguished at a cost of $15 before it had burned over six acres. The district fire warden stated that had the road not been cleared the fire would have swept over at least 2,000 acres and the cost of suppression would have been several hundred dollars. This one case more than repaid the town for its share of the cost of clearing these roads. In passing, it should be mentioned that because of the value of this work, as proved by the experience of this one season, the Fire Wardens' Association of an adjoining county has voted to ask for town appropriations to do similar work in that county.

Immediately following the educational campaign, the state forester selected two men who were familiar with the district to act as forest rangers. These men are expected to patrol all the roads, visit camp and picnic grounds, distribute fire prevention literature, interview the occupants of all automobiles found parked in the woodland or along the roadside, see that no brush or rubbish burning is done except under permit, report all fires and the cause of the same, suppress small fires discovered, dispose of fire hazards so fast as possible, such as the paper and rubbish left on picnic grounds, inspect town dumps frequently, and to keep the subject constantly before the public. The rangers are provided with Ford cars, equipped with small truck bodies, in which are carried a number of water cans with hand pumps, shovels and other tools

for fire suppression. They wear distinctive uniforms and police badges. They are on duty at all times, their rest days coming only when it is raining.

Although the rangers have the power of arrest, emphasis is placed on persuasion rather than force. Neither of them have had to make a single arrest. In their dealings with the public their attitude is one of friendliness and co-operation. They were selected for their ability to deal with people of all classes and they are men of vigorous physique and mature judgment. The success of this work is due largely to the care used in the selection of the right type of man for ranger.

Each of these rangers have interviewed and have distributed bulletins to several thousand people from all parts of the country and the most favorable reports have come from many sources. Automobiles with registration plates from every state, Canada, Mexico and Hawaii have been seen in this district in one tourist season. The roadside and picnic grounds were never so free from papers and rubbish, a fact that has helped to popularize the experiment with the summer residents. The rangers have extinguished many small fires themselves and in other cases they have held larger fires in check until the town fire warden arrived. They have been especially useful in assisting the local wardens in directing fire fighting crews, although this is not a part of their regular duty.

Committees of interested citizens have been appointed in each village to whom the rangers may go for assistance, information and advice. The purpose in creating these local committees in the thirty odd villages was to hold the interest of the leading citizens, who could be expected to talk about the experiment to their neghbors and to keep an eye open for temporary fire hazards and ignorant or intentional violations of the fire permit law. They were not expected to assist in the suppression of fires, or to spy on their neighbors, but rather to popularize the experiment in the community. Some of them have been very helpful in the raising of funds and in supplying information as to local conditions.

An association of the forest wardens of the district had been formed previous to the starting of the experiment and this organization has done splendid service in co-ordinating the work of the various local fire departments. It has created a spirit of confidence and co-operation among the wardens so that each is ready at all times to go to the assistance of any other warden when a fire occurs. This association holds monthly meetings at which the various problems of the forest warden

are discussed. Differences of opinion are thrashed out in open forum and many helpful suggestions have come from these meetings as the experiment has progressed. There was a time in parts of this district, as in many other sections of the state, when the fire fighters in one town would not go into another town to fight fire because reciprocal relations in fire suppression had not been established between the towns, but all this has been changed. Town lines have been practically eliminated and this association has been largely responsible for the improved conditions now prevailing.

The railroad which has been charged with being the greatest offender in the matter of starting forest fires has co-operated by having the grass and other inflammable materials burned on its right of way under the supervision of the local forest wardens and when requested it has put on trailers to follow the trains during excessively dry periods. With all these precautions, due partly to the bad fire season, the number of fires credited to the railroad have increased and an effort is now being made to require the railroad to burn oil in place of coal. The electric power lines have also co-operated with the local wardens in the disposal of brush.

HANDICAPS AND SPECIAL CONDITIONS

1. Owing to delay in the passage of the state's appropriation for patrol work the rangers were not employed until after one fire, reported to have been started by the railroad, had burned over about 500 acres. In a sense this loss should not be charged against the experiment, although it has been included in the figures of losses for this year.

2. Due to an unusually cool and dry spring the vegetation did not leaf out until later than usual, which condition prolonged the fire season. As a rule the most dangerous fire season of the year in this district occurs from the time the snow is off the ground until the undergrowth is in leaf. That period this year was fully two weeks longer than for the normal year.

3. A local real estate boom was staged on Cape Cod through the winter and spring which brought hundreds of strangers into this district, greatly increasing the normal population. These people were traveling through the forests during the dry season and they were responsible for many of the small fires. Scores of contractors were clearing tracts of land ranging from an acre to 100 or more acres in extent. These people generally were unfamiliar with the fire hazard on Cape Cod and many of the fires started by them got beyond control. This

was one serious cause of forest fires this year that did not figure in the records of the three years prior to the experiment.

4. From the first of March until the middle of May is usually the most dangerous part of the fire season, and the normal rainfall in that district for March and April is about 7.76 inches. This year only 5.98 inches of rain fell during that period, and this was the lowest record in the past ten years. For the first two weeks in May only about half an inch of rain fell, and this was distributed in several very light showers, which were little more than heavy dews. In the judgment of many of the older residents this was one of the worst fire seasons that the Cape has ever experienced.

5. One fire known to be incendiary in origin was started in the town of Falmouth on what was said to have been the worst fire day of the season. It came at the very end of the drought on May 14. The forest floor was like tinder and an exceptionally strong wind was blowing. At about ten o'clock in the morning the nearest lookout observer dected several fires starting almost simultaneously within a radius of a few hundred feet and these fires soon combined into one big fire. This was in a section where the topography was rough and the roads poor. The local fire department had been working most of the previous night on a fire that had been set, probably by the same person, and were still at work on it when this new fire occurred. That explains why the fire fighters could not attack the fire in its incipient stage. Driven by the strong wind, it soon reached the crowns of the trees. The flames traveled with great rapidity and immense volumes of smoke blinded the fighters, making supervision and co-ordination of the various crews extremely difficult. Sparks and embers were carried hundreds of feet in advance of the main fire and this burning material, falling on the dry floor of the forest, started hundreds of little fires which soon became a part of the main conflagration. The roads were blocked with automobiles containing sightseers or well-intentioned persons who had no equipment with which to fight fire. Orderly procedure was impossible. Since the men could not get within several hundred feet of the fire because of the danger of becoming lost in the dense smoke and trapped in the tangle of underbrush, the only chance to check the fire seemed to be to concentrate the men and the apparatus on one of the roads in its path and to set a back-fire. But the strength of the wind carried so many embers over the fire fighters that efforts along this line were futile. Three times the back-fire was attempted. Hundreds of men were called out, as is done at most big fires, but the majority of them were inex-

perienced in fighting fire and could not be effectively organized. It was not practicable or possible to properly supervise all of these men, yet their presence meant that most of their names were entered on the payroll. As a result, the cost for labor alone for this fire came to over $3,000 and one fire truck was wrecked. Although all of the fire departments of the adjoining towns responded to the call for help, the fire was not brought under control until the following morning. This one fire burned over an area of 2,500 acres, which is 66 per cent of the total acreage burned this year.

Various theories have been advanced as to the motive for starting the fire, but one of the most plausible is that a prominent local bootlegger who was arrested near to where the fire started was believed to have had a competitor with a still operating in that section, whom he wanted to put out of business. The evidence against this man, however, was insufficient to convict him. Believing that some one may know the facts and might be persuaded to disclose them, the Massachusetts Forestry Association offered a reward of $1,000 for information leading to the arrest and conviction of the incendiary, but as yet he has not been apprehended. A similar reward was also offered by the town, and this action on the part of the town and the association is believed to have had a good moral effect on the local residents.

RESULTS OF THE FIRST YEAR OF THE EXPERIMENT

1. Unless very abnormal weather conditions occur in the late fall, which are not anticipated, the fire season for this year is practically closed. There have been 138 forest and grass fires this year as compared to seventy-three, the average for the past three years. This increase of practically 90 per cent in the number of fires was due largely to the clearing of land in connection with the real estate boom and the presence of large numbers of people in the forests during the worst part of the fire season. This was a new factor in the fire prevention problem that was not present during the previous three years. Most of these people were non-residents and therefore it was not feasible to reach all of them through the educational campaign. Under those conditions the increase in the number of fires is not so surprising as the fact that the damage done was smaller than in previous years. Grass fires are classified as forest fires since many of them enter the forests, and because the forest warden is charged with their suppression. Before the experiment was started, very small grass fires were frequently

not reported, which probably accounts in part for the increase in number this year.

2. The total area burned in the six towns this year was 3,771 acres, and the aggregate cost of the educational campaign, the patrol and the suppression was $12,452, as compared with the average yearly records during the three preceding years of 9,363 acres burned and $9,829 spent for suppression alone. This shows an increase in cost, for education, patrol and suppression of $2,623, or 26.7 per cent higher than for suppression alone, but a reduction in area burned of 5,592 acres, or about 59.7 per cent. In other words, by spending one-fourth more under this system the loss in acres burned was reduced about three-fifths. This, however, is recognized as an exceptionally bad fire year and when we compare the figures of this year with those of the worst of the three preceding years, which were 21,444 acres burned and a cost of suppression of $9,924, we find that the cost has been increased by only 25.5 per cent, while the acreage burned has been reduced by 82.4 per cent.

3. The towns have appropriated more money for forest fire prevention than ever before, especially in connection with the brushing out of old roads.

4. A permanent improvement in the reduction of the fire hazard has been made by the clearing of the brush from over 120 miles of roads. This could not have been accomplished without the educational campaign.

5. Closer co-operation for fire suppression among the towns has been brought about through the educational work and the efforts of the rangers.

6. The roadsides and picnic grounds have been kept cleaner than in the past, and more attention has been given to town dumps which are located within the forest.

7. Problems such as burning the forest to improve the blueberry crop, improvement of fire fighting equipment, the reduction of suppression costs by the elimination of the curious and the untrained who attend large fires and get their names on the payroll, better police regulation at big fires, better organization of the fire departments and more stringent rules for the granting of fire permits are under consideration with some hope of solution.

8. Greater interest in reforestation has been shown because of this determined effort to solve the fire problem. The towns have con-

tinued their appropriations for planting on town forests, the state is establishing a new nursery on the state forest, and a few individuals have begun to reforest their idle lands.

To analyze these results, it must first be recognized that one year's trial of such an experiment cannot give sufficient data on which to base a future policy. It must be kept in mind that this area represents a special case, and whatever change in policy may be brought about through the facts established by the experiment, this district will always have a higher fire hazard than other parts of the state. On the acreage basis the costs for this year are still far in excess of the amount of money that should be required to give adequate protection to the average forest from the commercial viewpoint. By adequate protection we mean that the fire losses should be so reduced as to enable woodland owners to obtain forest fire insurance at reasonable rates. The real object of the experiment is to prove that money spent for prevention and suppression together will do more to reduce the fire losses than if used for suppression alone. Of course, prevention and suppression for the present at least must go hand in hand, but we hope to prove that, given a sum of money to protect a forest from fire, the emphasis should be placed on prevention rather than on suppression, which is the general practice today. Just what proportion of the sum should be devoted to prevention and what to suppression is yet to be determined, but it is hoped that this question will be answered by the experiment. It is obvious that these factors will vary with the local conditions, but if a system can be devised by which the relative proportions are established for an especially difficult area such as this, it should be comparatively easy to adjust the system to the local conditions in any district. Should it be proved—and it now seems likely that it shall—that if half or more of the money now spent for suppression were used in advance for prevention it would result in less area burned than if all the money were spent for suppression alone, the experiment will be a success. The cost of the educational and patrol work this year was 54 per cent of the total cost. It is not the amount of money spent that counts so much, as what we are getting for it. If the old proverb that "An ounce of prevention is worth a pound of cure," holds true in other things, surely a half pound of prevention applied to forest fires will be worth a half pound of suppression. Of course the ideal is to practically eliminate forest fires as has been done in certain sections of Europe, and eventually we may find that it will pay to spend *more* money for prevention than for suppression, which would reverse our present

policy. Should the results of the two succeeding years prove as favorable as those of this year, with all the handicaps of this year considered, the experiment will certainly lead to a radical change in the forest protective system in Massachusetts.

The first year of the experiment has cost more for the educational work and for patrol than will be necessary during each of the remaining two years. The cost of automobiles and equipment for the rangers, for example, was all charged to this year, but most of that equipment will last throughout the three years and some of it much longer. This should reduce the cost for patrol by about $1,000 for each of the two following years. In the educational work it will not be necessary to devote so much time in the future to lectures and organization as was done in the campaign of this year. Every resident of the district now knows what is being done, and to some extent the results that have been accomplished. At least a thousand dollars can be lopped off of this year's expenditures for educational work for each subsequent year. Had it been possible to prorate these initial costs the showing for the first year would have been stronger. It was recognized in the beginning that more money would probably have to be spent during the first year for education, patrol and suppression than had been spent on the average annually for suppression alone, because it was necessary to start with an intensive educational campaign. It seemed advisable during the first year to prove to the local people, that the acreage burned could be reduced, even if the cost exceeded the expenditures of former years, and this has been done. Now that it has been shown that the losses can be reduced the next step will be to lower the costs and still hold the number of acres burned over to a minimum. It will not be possible for a private organization like the Massachusetts Forestry Association to bear the cost of the educational work for the whole state, but it is believed that the rangers can be trained to do the educational work which will be done during the winter months. This will insure steady employment for the rangers and thereby enable the state to secure and hold good men for this work from year to year.

The most encouraging feature of the whole experiment thus far is the change that is noted in public sentiment toward the fire problem. The people now have renewed hope that productive forests can again be established on Cape Cod. Practical suggestions are coming from unexpected sources, showing that a spirit of co-operation has been thoroughly established. The business interests, for example, are taking an active part in the experiment. If no other results of value come from

this movement, what has already been accomplished in arousing the interest of the people in this district is worth more than it has cost. After all, a change in public sentiment regarding the prevention of forest fires is of prime importance and the most vital factor in the whole problem.

From the educational standpoint the agencies engaged in this work have been in the position of salesmen introducing a new product. The laws of salesmanship embody four distinct steps in the sale of an article: namely, (1) favorable attention of the prospective buyer; (2) creation of interest in the article to be disposed of; (3) intensification of that interest to the point of desire in the mind of the customer; (4) and finally, action—or signing the dotted line. The methods used in the educational campaign have attracted favorable attention because the publicity was obtained chiefly through personal contact. Interest was aroused partly because of the novelty of the program, which centered public attention on the district, but chiefly because it was shown that the prevention of forest fires meant a monetary gain to all the people in the district. The earnestness and thoroughness with which the rangers went about their work created a desire on the part of the local people to help, and the action is noted by the appropriation of public funds, and the contribution of private funds to carry on the experiment. There is convincing evidence that the idea of forest fire prevention is completely sold to the people of this district, and if so the ways and means of bringing it about will be found. What the people really want, they get.

In conclusion, it is evident from the foregoing data that a combination of education, patrol and suppression in the prevention of forest fires is superior to suppression alone. From the information thus far obtained it seems conservative to predict that in the protection of a forest from fire, if half or more of the money available is spent in advance for prevention, through education and patrol, less loss will be sustained than if all of it is used for suppression after fires are started. While it would not be wise to attempt to revise a forest protective system on the results of only one year's trial of the experiment, the fact that this plan has withstood the strenuous test of the past season, is a strong indication that it is sound. Should the record of the two succeeding years prove as favorable or better than that of the past year, the experiment will certainly lead to a radical change in the forest protective system of the state. It must be kept in mind, however, that this is simply an experiment and as such, negative results may, in the long

run, be as valuable as positive results. The information sought is highly desirable, if not absolutely necessary for the solution of the forest fire problem. Our federal and state governments are slow to change policies, and to secure public funds for *fire prevention,* in place of or even supplemental to those now provided for suppression only, will require facts such as this experiment is designed to establish. The experiment is really a research problem in mass psychology. How, at reasonable cost, can the public mind be brought to accept its responsibility in the matter of fire prevention? If by actual experiment, in which which the public plays a prominent part, the money value of education and patrol can be determined, it will be a long step toward the solution of this national problem. The final solution will not be found until some practical way is discovered to mould public sentiment in opposition to the careless use of fire in the forest. "With public sentiment nothing can fail—without it, nothing can succeed."

SOME DETERMINANTS OF PHILIPPINE FOREST TYPES

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Introduction

The forests of tropical lands are receiving more attention from the world at large as those forests of the temperate lands reach that stage of exploitation where future supplies must be looked for. Both quantity and quality demand for tropical woods, will, in the immediate future, accelerate exploitation of tropical forests. As this demand grows so must these forests be more carefully studied with a view to the future supplying of world market.

The bulk of the forests of the Philippine Islands in common with those of the wet regions of Indo-Malaya, are chiefly of the family *Dipterocarpacea.* These forests present a rather wide range of silvical characters which may make them undesirable for future perpetuation. But the fact remains that these forests occupy 95 per cent of the forest lands and in order to provide against timber shortage, and the increase of idle lands of the country, at least part of these forests must be kept productive pending the time when some other type of forest may be produced. If this is to be done and if the forests are to be properly utilized and maintained, knowledge of their silvical characters is the first essential.

The most intensive silvical studies of Philippine forests were made by Dr. H. N. Whitford, 1906 to 1911, in Vegetation of Lamao Forest Reserve," *Journal of Science* Vol. I and "Forest of the Philippines" Bureau of Forestry, *Bulletin No. 10.* A later and more extensive work was; "Philippine Dipterocarp Forests" by Brown and Mathews. Since the issuance of the latter work no special silvical studies of the Dipterocarp forests have been made. However, from various sources considerable additional information as to distribution of species has accumulated. This comes chiefly from timber reconnaissance for exploitation and for land classification in which little attention has been given to silvical conditions.

It is the purpose of this paper to review the salient silvical facts developed in this previous work and to add, wherever applicable, casual personal observations; thus perhaps the trail may be made a little

wider or extended further toward the ideal of a knowledge of Philippine silviculture.

Orientation.—The dominant ecological factors in plant life are soil and climate. These involve many inter-related elements. Geological structure and mineral content of rocks determine in a large measure both physical and chemical composition of soils resulting from their distintegration and decay. Climate is governed by the geographical position and topographical character of the country. It is necessary to consider all these elements.

Geography.—The Philippine Islands lie about 500 miles from the east coast of Continental Asia, between 116° and 127° East Longitude and between 4° 30′ and 21° 30′ North Latitude. The geographical relationship to Asia is clearly shown by an oceanographic chart of the region. They stand as a group of projections separated from Asia by a comparatively shallow sea, the result of folding on the edge of the Asiatic Continental shelf, while on the Pacific side they face the great Mindanao Deep. Closer study of this chart shows a more intimate geological relationship to Southern Asia through the chain of the Indo-Malayan group of Borneo, Java, Sumatra and the Malay Peninsula. This idea is also supported by the testimony of botanists and paleontologists. It is well to bear in mind this relationship when considering the fauna or flora of the Philippines. An important geographical feature is the breaking up of the land mass into numerous islands. There are some 35 principal islands, about 3000 secondary islands of which 462 have an area of over one square mile, and about 3000 other islets and extruded reefs.

Physiography.—As before stated the formation of the islands is the result of folding. This is expressed in two principal trends, the major one a Northwest to Southeast trend including lower Luzon, Masbate, Samar, Leyte and Eastern Mindanao. The other trend takes a Northeast-Southwest direction and is found in two parallel lines projecting toward Borneo, represented in the attenuated island of Palawan on the north and the chain of the Sulu group to the south, inclosing the shallow Sulu Sea. This trend appears to meet the other somewhere in Central Luzon, north of which the Cordillera swings into a North and South direction. Thus the dominant physiographic feature is the drawing out of the principal land masses along a Northwest-Southeast axis with the main mountain ranges and river systems following the same lines.

Secondary diastrophisms, vulcanism and other processes have of course modified this condition, as for example the volcanic tuff fill in the western Luzon Plain changing the outlet of the Pangasinan River from Manila Bay to Lingayen Gulf.

Diastrophism.—Much of the uplift and drowning of land masses is recent. According to Dr. W. D. Smith (11)—"In the Philippines, within the relatively short period of time since the Pliocene there has been an elevation of the Northern Luzon block amounting to about 1,980 meters and within the Pleistocene a noteworthy submergence in other portions." The framework of Northern Luzon is diastropic uplift. (This has an important bearing on the vegetation types as will be shown later.)

Vulcanism.—Although vulcanism may be considered a superficial physiographic process its importance in the Philippines is much in evidence in the topography and soils. Much of this activity is also recent, from the geological viewpoint.

Gradation.—Taking into consideration the newness of land formation and knowing the torrential rainfall common to most tropical countries one would expect here—which is generally true—a very active gradation. This results in many landslides, formation and drainage of lakes, heavy deposition and other features of a new physiography.

Topography.—Considering the above as the essential physiographic processes, we have a drawing out of the land masses along two main axes, recent diastrophism and vulcanism and a very active gradation, combining to give a definite characteristic topography, the conspicuous characters of which are: (1) Irregular and very extended coast line. (2) Great development of mountains. (3) Narrow and broken coastal plains. (4) Principal mountain ranges and river systems taking the Northwest-Southeast directions.

On the whole a topography which may be called young.

Geology.—The principal exposed rocks found in the Philippines are of the following classes:

(1) Extrusive; both basaltic and andesitic, the latter predominating.

(2) Tertiary and more recent sedimentaries, largely limestone, (true quartzsandstone is rare).

(3) Volcanic pyroclastics and tuffs.

(4) Intrusives; diorite, syenite, rarely granite or gabbro. (Usually found only in the higher cordilleras.)

(5) Metamorphics: Igneous deritives are principally schists. Marble is found only in the island of Romblon.

General Classes of Soils.—Probably the greatest in extent are the sedentary soils derived from volcanic deposits. These vary in composition and texture with the original rock and the soil-forming processes of the locality. This type includes practically all of South-Western Luzon, part of the Central Luzon plains and great part of the Bicol peninsula on the island of Luzon. It also covers parts of Masbate, Leyte and Samar and is very extensive in the western part of the island of Nagros. It covers practically all of the Island of Basilan and the larger ones of the Sulu group. Large areas but of unknown extent are found in various parts of Mindanao. Wherever there is a considerable ferro-magnesion content combined with moderately heavy rainfall, this soil tends toward laterite.

The second most important soil class as to origin is from sedimentaries, principally limestone. The resultant soils vary from the black, friable, residual soil from some of the older purer limestone, as in eastern part of the Cagayan Valley, to the lighter yellowish clayey soils from the impure beach limestones of southwestern Tayabas.

Tuff deposits vary from fine even texture as those of southwestern Luzon to coarse scoriaseous fragments and from andesitic and other felspathic varieties to basaltic, and produce soils ranging from light yellowish and clayey soils to dark-red-brown friable sandy to clay loams. *Intrusive rocks* as the quartz diorite of North Central Luzon produce relatively sandy and poorer soils.

Metamorphic rocks largely represented by schists usually produce poor soils owing to the hardened or vitrified condition and to mineral content of these rocks.

Alluvial.—Alluvial soils cover the central, littoral and valley plains. a large part of the Central Luzon plain, the Cagayan, Cotabato and Agusan Valleys and the numerous small littorals. These are of minor importance to forestry because the comparatively small area has practically all been deforested and is agricultural or potentially agricultural land.

Certain characters of Philippine soils distinguish them. (1) Their newness. (2) Large extent of volcanic derivations. (3) Comparative scarcity of quartz sand. (4) Clay soils rarely found. (5) Tendency toward laterite in regions of heavy rainfall. (6) Structure of the soils deep and loose owing to their derivation from deep volcanic deposits. (7) Humus material is generally abundant though there is usually no

great accumulation of humus in the soil owing to leaching of heavy rains.

Climate.—In considering the climate of the Philippines we find certain characters in common with other tropical regions as compared with countries of the higher latitudes.

Temperature.—

(1) The amount of heat received from the sun per unit of time is greater owing to direct solar radiation.

(2) Greater local variation in temperature due to a steeper vertical temperature gradient with variation in altitudes.

Winds.

(1) Winds come into cyclonic depression chiefly from one direction.

(2) Sea breezes more common owing to the fact that the land is, relative to the ocean, more continuously heated.

Humidity.—Great moisture capacity of the warmer air.

Precipitation—

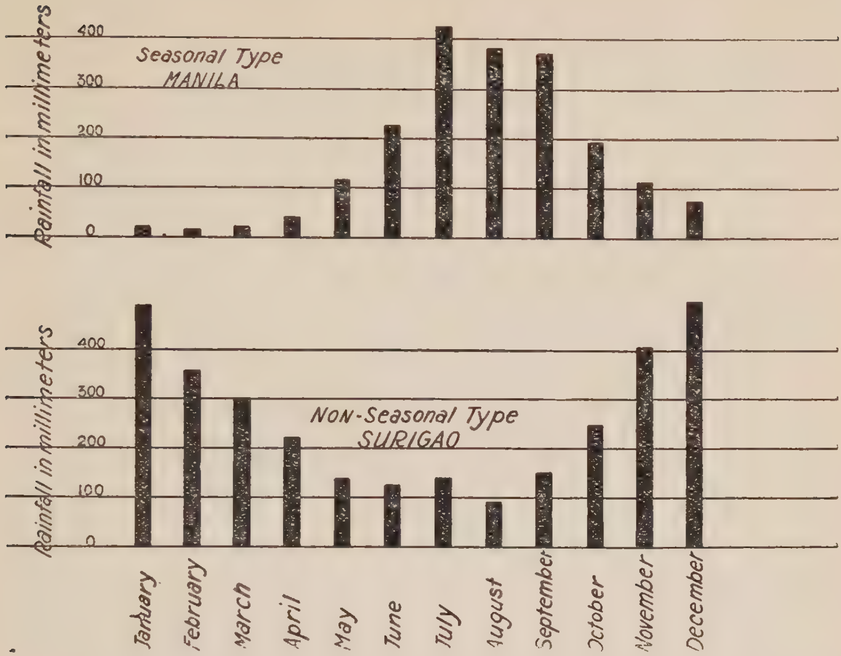
(1) Greater intensity of rainfall.

(2) Greater local differentiation in rainfall.

There are certain characters which may be said to be peculiar to the Philippine Islands:

First.—The geographical location with reference to continental Asia and the Pacific Ocean with their shifting center of high and low pressures brings the Philippines directly under the influence of the prevailing winds, the monsoons and the cyclonic winds, and attendant storms, or typhoons.

Second.—The direction of the axis of the island group and trend of the mountain systems relative to the direction of the monsoons winds, which are the rain-bearing winds, divides the land into regions of seasonal and non-seasonal rainfall. The Northeast monsoon brings rain to the eastern coasts from December to February, while other parts of the islands have a comparatively dry season. The cyclonic storms, usually from May to November, bring rains which are general. Thus the Eastern coasts or any part exposed to both seasonal winds have a continuous rainfall while the other regions have a more or less distinct dry season. The Philippines Weather Observatory distinguishes two intermediate types but these are concerned with a more intensive study than is here attempted. (See chart, page 807, showing two extreme climatic types from the records of two typical regions.)



Third. The position of the Islands with relation to Oceanic currents. The North Equatorial current washes the Pacific shores of the Philippines North of the eighth parallel, and exercises a considerable influence as an equalizer of temperatures.

Review of the foregoing physical description of the country brings out the important point that there are two principal ecological factors. These are (1) soils, especially volcanic and sedimentary derivatives and (2) climatic conditions, especially seasonal rainfall. It is in the various combinations of these two factors we should expect to find the determinants of our forest types.

Classes of Vegetative Cover.—There is ample evidence that practically the entire land surface of all the principal islands was at one time covered with forest growth (the writer has found large petrified dipterocarp trees within the city limits of Manila). The present condition of the land, however, is about as shown in the following:

Class of Land	*Area Sq. Miles*	*Per cent of Area*
1. Virgin forests	40,000	33
2. Second growth forests (Brush Land)	20,000	17
3. Grass land	48,000	40
4. Cultivated	12,000	10

Probably the best approach to a study of forest types is by an investigation of conditions in the virgin forests where the process of adaptation approximates final adjustment. Six distinct types have been outlined by Whitford as follows:

		Per cent of area
1.	Dipterocarp (5 sub-types)	75
2.	Molave type	10
3.	Mangrove type	2
4.	Beach type	
5.	Mossy forest	8
6.	Pine type	5

Type Distribution.—The first five types are representatives of the humid tropics and are distributed throughout the southern islands of the group and in Luzon with exception of the highlands of the Cordillera Central which is occupied by the pine type. (Small areas of pine are also found in Zambales and Mindoro.) The two meet at about 3,000 feet above sea level. Here the transition of almost the whole flora is abrupt. This sudden meeting of a temperate zone type of vegetation in a tropical island arouses a questioning interest in the history of plant distribution. Dickerson has discussed this very question and quoting Merrill he says:

> The flora of the Benguet-Bontoc region, an area essentially characterized by the dominance of a species of pine *Pinus insularis* Endl., is in striking contrast to that of other parts of the Philippines, presenting very numerous northern types that do not occur elsewhere in the Archipelago and indicating a derivation, so far as these northern types are concerned, from the central mountain mass of Asia, many of the same types being found in China, Japan, and the Riu Kiu Islands, and most of them in Formosa. Northern Luzon and Formosa, in numerous cases, present the most southern and eastern extension of the Himalayan flora, many of the Himalayan types found here not extending into the Malay Archipelago. Practically all of the Himalayan types found in northern Luzon also occur in Formosa, as noted above.

But Dickerson states that this temperate flora could not have survived the warmth of the Philippine lowlands and therefore concludes: "that in the northern half of Luzon distant mountains were present and upon these elevations the ancestral stock of the present upland flora was preserved." Admitting the main point that the pine type has immigrated from the north, the lowland species have also emigrated from the south. The Benguet Pine (*Pinus insularis*) has been found to thrive in the lowlands, but only where isolated from competition with lowland types. Also scattered representatives of the other

types of forest are found on moister sites as high as 6,000 feet elevation in the Benguet Pine region, but these are of poor development and evidently out of the optimum range. The order of the two immigrations is explained by Merrill. He says: "It would seem that from the time these Himalayan types reached the Philippines there has been continued high elevation in some part of the Benguet-Bontoc region, which has allowed them to persist. Most or all of them cannot grow under present climatic conditions at altitudes of 2,000 meters."

As far as Malaysia as a whole is concerned there were apparently two independent series of migration of Asiatic types; one through the Malay Peninsula to Sumatra, Java, Borneo, and the Philippines, and an earlier one through Formosa and Luzon to the Philippines, a few of which extended southward to Celebes.

Thus it would seem that pine is a permanent, temperate type which has persisted in the tropics owing to the preservation of conditions in the Luzon highlands, approximating temperate zone conditions. Here is found the widest range of temperature, humidity and distribution of rainfall, climatic extremes which seem to be the determinant of the type.

The Mangrove Type.—The mangrove type is also a very distinct type. Its determinants are clearly marked by the limits of brackish tide water. It reaches best development in the salt-water swamps and the mouths of rivers, and it advances seaward into pure saltwater to the mean depth of about two meters wherever wave action will allow it root-hold. In the composition of this forest six species of the family *Rhizophoracea* are found. Other principal species are: Pagatpat (*Soneratia pagatpat*), Tabao (*Lumnitzera littorea*), Tabigi (*Xylocorpus olvatus*) and Dungon late (*Heritiera littoralis*).

The silvical requirements of these types are distinct and well known and need no further discussion from this standpoint.

Dipterocarp Types.—The dipterocarp family is known to dominate all of the wet regions of Indo-Malaya, but has been checked on the west from spreading to Africa, by the intervening deserts. It has been estimated that the dipterocarp forests make up 90 per cent of the volume of timber in the Philippine Islands. They range from their contact with the mangrove swamps near sea level up mountain slopes to elevation of 2,700 feet (800 meters), and in both regions of periodical and continuous rainfall, through various types of soils. They are apparently barred only from sites where there is a combination of soil and dryness unfavorable to their growth. Between this limit

and the optimum there are found various associations of the species of the family *Dipterocarpacea* together with other secondary species, which appear as a gradation of types adapted to various site conditions.

The following types have been named: (1) Lauan type, (2) Lauan-Hagachac, (3) Yacal-Laun, (4) Lauan-Apitong, (5) Tanguile-Oak.

The Lauan type.—Whitford says this type is confined "to regions of short or no dry season"—and occupies the bases of mountains up to 400 meters, giving the following composition:

	Per cent
Shorea sp., Red Lauan	40
Shorea, Almon	20
Dipterocarpus graniflora—Apitong	15
Shorea polysperma—Tanguile	13
Pentacme contorta (White Lauan) Parashorea Malaanonan (Bagtican)	7
Other species	5

This is in the forests of Northern Negros, a region of short dry season with a rainfall of 2,000 mm. annually. The soil is a deep, reddish volcanic sandy to clay loam with scattered volcanic bombs. It has been observed that in the better, looser soils there is a uniform variation toward pure lauan-tanguile stand, the apitong disappearing. A more striking example of this variation in composition with soil was noted in the Island of Basilan. Here the rainfall of 1,800 mm. is uniformly distributed throughout the year. The large interior basin of this island ranging in elevation from 1,500 to 2,000 feet has a very deep volcanic soil with a few scattered low hummocks where occasional rocks outcrop. The forest of the basin is practically a pure lawan stand of Mayapis Lawan (*Shorea Squarnata*), Red Lawan, White Lawan, and Tanguile with the exception of the hummocks which appear as islands of Apitong. Climatic conditions are unquestionably uniform yet the forest composition is marked by a distinct change apparently in conformity with the more stony soil.

The Lauan-Hagachac Type. According to Whitford this type is confined to regions of the same climatic condition as lauan type and to areas where the water level is near the surface such as river bottom and deltas. He considers it a complex of sub-types in process of change, owing to the unstable nature of the habitat, changing level of ground water and similar factors.

A typical composition is:

	Per Cent
White Lauan	40
Guijo (*Shorea guiso*)	9
Apitong	4
Hagachac (*Dipterocarpus affinis*)	10
Miscellaneous species	37

In this, estimates of stand of timber only merchantable, that is, trees forty centimeters or over in diameter, are considered. The secondary species vary with the proximity to the beach or to the higher land, where the percentage of Lauan diminishes or increases respectively. This type occupies a site most subject to change both natural and artificial. In many parts of the Philippines the narrow coastal plains and river flats have been frequently subject to lowering or elevation due to tectonic disturbances. With lands of this character a slight changing of elevation may eliminate certain species or change the entire type. An extreme instance of this is found on the west coast of Cotabato, Mindanao, where a river flat occupied by this type has become semi-submerged due to earthquake. Here Dipterocarps are dying and mangrove species are invading the area. The liability to seasonal flooding has been mentioned. Occupying as it does the more accessible lands this type has in many places been modified by clearings or by continued selective cutting of certain species often to the extent of extermination of those species.

The Yacal-Lauan type. Described by Whitford as occupying "the low coastal hills whose basal rock is volcanic"—where there is a short dry season and usually with less rainfall.

A typical stand of this type is:

	Per Cent
(*Hopea plagata*) Yacal	18
(*Pentacme contorta*) White Lauan	7
(*Parachorea Malaanonan*) Bagtican lauan	5
Dipterocarpus species	6
Various species of *Shorea* and *Vatica*	10
Other species	53

Yacal is usually the most numerous single tree species. Contrary to the statement from Whitford this type is well developed in regions of uniformly distributed rainfall and on various rock formations. There are excellent stands of this timber on the east coast of Tayabas

province which has an annual rainfall of 3,000 mm. and no marked dry season. The soil here is sedentary derived from uplifted beach limestone. It is also the predominating type over considerable areas on the Cotabato Coast. Here there is a uniformly distributed annual rainfall of 2,200 mm. The soil is principally from sandstone. If we are to take Yacal as the index species of this type it would seem that it is determined more by drainage and acriation due to sea breeze, which probably regulates humidity. Several instances were noted of an abrupt disappearance of the Yacal when passing to inland country of topography similar to the coastal hills but sheltered by them from sea breezes. Also within the type itself there is invariably a tendency to dominance of the Yakal on the most exposed ridges. The writer believes that Whitford has underestimated the range of this type.

Lauan-Apitong Type. This type has been distinguished by Whitford as corresponding in soil, topography and altitude conditions to the Lauan type but defined by having a longer dry season. A typical forest composition is given below:

	Per Cent
(*Dipterocarpus grandifloris*) Apitong	30
(*Dipterocarpus vernicifluris*) Panao	30
(*Pentacme thurifera*) White Lauan	24
(*Anisopter thurifera*) Palosapis	10
(*Shorea polysperma*) Tanguile	6
(*Shorea guiso*) Guijo	5
Other species	25

The type is semi-deciduous showing adaption to a seasonally dry site. Other indicators of this are: presence of bamboos, well known throughout Indo-Malaysia as marking a dry or seasonally dry climate; the frequent occurrence of Cupang (*Parkia timoriana*), a tree very common in western Luzon and always in xerophytic association. Another possible index of this type is the occurrence of Palosapis which is found to be one of the first of the dipterocarps to invade dry cleared lands. This will be discussed later in connection with Parang type. Absence of Red Lauans should also be noted.

Reviewing the above we may suppose that climate is the dominant factor in determining this type.

The Tanguile-Oak type. Ranges in elevation above other dipterocarp types. The name indicates the principal species in composition. Whitford does not state clearly the determinants of this type, but only that the range is from 500 to 900 meters (1,500 to 3,300 feet)

above sea level, "that rainfall is more evenly distributed and relative humidity constantly higher."

A conspicuous feature of the type is dwarfing and disappearance of the dipterocarps. Brown eliminates the factors of soils and rainfall and attributes the dwarfing of the trees to low light-intensity and temperature.

This seems the most apt explanation. The writer has observed that on some mountains the type does not appear until the upper limit, stated by Whitford, is reached and continues above, while on others the type is entirely lacking and the dipterocarp extends above 3,000 feet elevation. This probably, in a way, corresponds to conditions on mountains in the temperate zone where the "timber line" usually marks the limit of perpetual snow. Here an almost perpetual fog or cloud belt is found on some mountains at an approximately fixed elevation, whereas on other mountains it may be at higher or lower elevation or of very infrequent occurrence.

The Mossy Forest Type. May be said to be the mountain top type. It is characterized by an abundance of mosses, liverworts, ferns, selaginellae, often rhododendron and other shrubs and some of the trees of the Tanguile-Oak type, such as *Quercus* and *Eugenia,* and others. The trees are very much dwarfed. Whitford attributes this to exposure to wind. The writer is inclined to believe it is due more to an augmenting of the conditions (i.e., cloudiness) producing the same effect in the Tanguile-Oak type into which this type merges below.

The Molave Type. Has been identified with the limestone hills of the coasts. The type is not well established for the reason that virgin forests are rare. But the comparatively short, irregular boles and deciduous habit of most of the species indicate adaption to a scanty or rocky soil and to dry or periodically dry conditions.

The type takes its name from Molave, which is the most numerous and widely distributed tree species in the type.

A typical Molave forest in Southern Mindanao contained:

	Per Cent
(*Vitex parviflora*) Molave	30
(*Tristiana sp.*) Tiga Malabayabas	20
(*Terminalia Calamansanai*) Magtalisay	8
(*Dracontonelum Cuningianum*) Lamio	5
(*Euphoria Cinerea*) Alupag	5
(*Parinarium Corymbosum*) Liusin	2
Miscellaneous species	30

Some forests of the Molave types, with Molave as the dominant species, contain species as: Tindalo (*Pahudia rhomboidea*), Supa (*Sindora supa*), Ipil (*Intsia bijuga*) and others. This is also probably a normal composition since these secondary species are known to be intolerant and of slightly higher soil requirements than Molave, hence there would be little tendency toward competition.

The following cases are given to illustrate varying site conditions of Molave type.

Case No. 1. This is the case of a forest where Molave type joins but is in sharp contrast to a dipterocarp type. The location is the east slope of Sigaboy Peninsula, Mindanao. The divide of this peninsula is about 3,000 feet in elevation and is of a much broken but rounded topography, moderate slopes run down to within about three kilometers of the sea where a sharp shoulder is formed by a sudden downward break in the gradient. Explanation for this topographic feature probably lies in the geological structure of the peninsula, the central core of which is gabbro, whereas the outer shell is somewhat shattered quartz-mica schist, the surface boundary between the two formations being practically coincident with the change in gradient mentioned. The significance of this from a silvical standpoint is realized when it is seen that the forest types conform also to these two formations. From the shore line to the top of this shoulder is a pure Molave type, at that point a Yacal-lauan type begins marking a boundary so distinctly that it can be recognized at some distance by the constrast in color and density of the foliage. For a definite conclusion as to type determinants in this case, much information is lacking on climatic factors in particular. But it is improbable that a difference in rainfall which might occur owing to difference in elevation would result in such an abrupt change in forest type, whereas the close conformity of type with rock formation would seem to point to the soil as the dominating factor. The mica-quartz schist produces a poor, sandy dry soil whereas overlying the gabbro formation the soil tends toward a clay type, although both soils are shallow and stony.

Case No. 2. Instances are found of Molave growing as scattered trees or patches in dipterocarp forest such as the Yacal-lauan type.

Case No. 3. Might be called an extreme case, where scattered Molave are found growing in the Lauan-hagachac type. The latter case being rare, might be said to be unimportant, except for the fact that it seems to have a bearing on the understanding of type requirements in general. Invariably where Molave is thus found it is

represented by mature trees only, no reproduction is taking place and Molave is evidently a vanishing species due to some change in site factors which has favored the development and encroachment of the dipterocarps.

Case No. 4. Occasionally, on better soils where isolated from competition with dipterocarp species, Molave forests are found and here produce usually large well-formed boles.

General Type Requirements. As was previously stated, the dominant ecological factors are soil and climate. It appears that quantity of rainfall in the Philippines is not the most important determinant, but that periodicity exercises the greater influence. With soils it is not one character but the combined characters which make the determinant. A very porous soil even though it receive abundant rainfall, because of its inability to retain moisture may approximate a dry soil, or the inverse may be true. Likewise porosity, drainage and evaporation are modifiers of soil depth. We are dealing with two variables; soil composition and moisture. If we proceed logically we must choose conditions where one of these elements is fixed while studying the effect of the other.

Deep Soils. Given a deep, well-drained soil, we find under varying conditions of rainfall, some one of the *dipterocarp types.* With the same soil conditions, but with a uniformly distributed rainfall we find the forest tends toward the *pure lauan type* including Red Lauan. Given again the same conditions but with the special modification of a volcanic soil the tree composition tends toward a preponderance of Red Lauan and timber attains maximum size and density. We may say then that Red Lauan is the index tree of the Lauan type representing the optimum conditions for forest growth. Where there is no dry season to check continuous growth, and a deep, moist but well-drained soil permits crowding and formation of dense leaf canopy, Red Lauan is dominant. Hence the largest trees and heaviest stands are found in the Red Lauan forests.

Shallow Soils. Given a condition of shallow soil.

(1) Moderately dry we find Yacal, Liusin, with scattered Molave.
(2) Shallow soils very dry, the proportion of Molave increases.
(3) Shallow dry limestone soils, Molave becomes the predominant species.

We then conclude: Molave is the index tree for this type. The above examples of Molave forests have been given numbers for further

reference. It is believed that the Molave represents a climax type and that therefore a more careful study of this type correlated with the dipterocarp types would shed much light on the determinants of types in general.

Reviewing the foregoing examples of Molave forests: lack of intensive study does not allow a positive statement as to determinants of type but at least a speculative interpretation of the conditions found may be advanced.

In case No. 1, we find a pure Molave type forest distinctly marked off from the dipterocarp. We can assume that, along the type boundary at least, climatic conditions are uniform. This points to the difference in soil as the determining factor.

Case No. 2 seems to represent a condition where both soil and climatic condition are uniform. The Molave is found thriving interspersed in the Yacal-Lauan type. This would seem to indicate site conditions intermediate in requirements between the two types.

Cases No. 3 and 4 tend to prove that Molave will grow on sites of the other dipterocarp types but it cannot endure competition with dipterocarps. We may deduce then that the Molave type is limited only by competition with dipterocarp types or we may say by the *minimum site requirements of the dipterocarp types.* The index tree of this minimum limit seems to be Yacal.

We find, then, standing at the two extremes of the range in forest types: Molave representing the minimum requirements and Red Lauan representing the optimum. If the two elements, soil depth and moisture content, are arranged on a co-ordinate scheme and some of the more common species placed in accordance with their combined site conditions the result would be about as shown tabularly on page 817.

It can be noted from this that those species having medium requirements have the widest range; for example, Tanguile and Apitong, while those standing at the extremes are the most restricted.

The writer fully realizes the lack of silvical data for the accurate delimiting of species and types. Index trees and plants should be worked out, studies of soils, root development, tolerance of shade should be made. We should also know what is going on in the logged-over areas, in the brush land and second-growth forests. Plant and tree formations on such areas are undergoing changes which, if understood, would throw much light on Philippine sylvics. All these are needed to combine with extensive and intensive ecological studies of the virgin forests.

MOISTURE CONTENT

		High	Medium	Low
Soil Depth	Shallow less than 20 cms.	Red Lauan Mayapis	Bagtican Panao	Bankal
	Medium 20-60 cms.	Hagachac	White Lauan Tanguile Apitong Palosapis	Alupag Tiga Tindalo
	Deep 60 cms.	Dungon	Yacal Liusin	Molave Teak

(Note: Mayapis seems to have requirements identical with Red Lauan.)

The field of study may be graphically represented as a set of maps. If three detailed maps were available showing on the first, soil types, on the second distribution of rainfall, on the third distribution of timber types, and if these maps were superimposed one on the other, we should have a composite of the essential data for studying the forest types of the country.

RELATION OF ROADS TO FOREST MANAGEMENT*

By Fred Morrell
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Roth, in "Forest Regulations," says, regarding the function of forest roads: "They make the forest accessible and enable transportation of material and timber into and out of the forest. They connect different parts of the forest itself and facilitate work, especially protection. They enable general travel through or across the forest. The relative importance of these functions varies with locality and topography."

The Federal Highway Act and the Department's regulations for its administration divide roads into two classes. Roth's functional division is recognized in this classification. Forest highways are in the main those roads which are considered necessary for travel through or across the national forests. The main purpose of these roads is to provide travel facilities to serve needs not occasioned primarily by use of the forest property. Roads needed primarily for exploitation of forest resources or for protection of the forest are classified as development roads. Separate funds are provided for the construction and maintenance of each of the two classes. The forest highway system as approved for the national forests of District One includes 1,665 miles of roads, the great majorityof which are to replace existing but unsatisfactory routes. The present approved system is doubtless far short of what will be considered necessary within the next quarter of a century. "To enable general travel through or across the forests." Some projects now recognized as desirable have not been included on the system because there is no advantage in including them until present traveled routes are brought up to a satisfactory standard. Increased population of the region and increased use by summer visitors will doubtless result in the construction of many miles of additional road across the forest to serve this purpose of getting through and across them. A brief review of the development along this line within the last decade may serve to emphasize this point. Within the last year a route has been opened to travel from the Bighole Basin, on the Montana side, south to the Salmon River in Idaho. A year ago there

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was no road that could be traveled by automobile from Montana into Idaho over the 400 miles of boundary line from the Short Line on the east to Wallace on the west. One additional route is under course of construction, namely, the Lolo Pass road, but will not be completed for a number of years to come. In Montana there is no route open from the Missouri River drainage on the east to the country on the west between Missoula and the Canadian line, a distance of about 150 miles, air line. Within the next two or three years an automobile road will be opened through the national forests paralleling the route of the Great Northern Railroad. It is reasonable to expect that additional routes such as these will be constructed in the future across the great areas of national forest land. What has happened in Colorado within the last fifteen years is an indication of the very rapid development along this line. When long distance travel by automobile began to assume large proportions about fifteen years ago, such travel as there was from eastern to western Colorado was all routed over one pass and that one a very poor road. Automobile travel passes over the Continental Divide in Colorado now in not less than ten places and every one of these roads passes through national forests.

Forests smaller in size and surrounded by land developed for agricultural purposes or in which there are settlements occasioned by mining have experienced rather extensive road development which is not occasioned by exploitation of the forest resources. The Black Hills region of South Dakota is a good example of this kind of forest. On such forests the road development needed for exploitation of forest resources will apparently be greatly aided by construction of this class of roads. The larger forest regions, such as we have in western Montana and northern Idaho, where road construction is expensive and where the values other than timber are small, apparently will not experience a road development for purposes of crossing that will come as near providing needed transportation routes.

The following figures, showing intensity of road systems in some forests of Europe, as given by Dr. C. A. Schenck, will be of interest from the standpoint of what road development has taken place on forests that have been under management over long periods of years. In the forests of Baden, one mile of road for every 200 acres; in Guttenberg, one mile of road for every 115 acres; in parts of Switzerland, one mile of road for every 40 acres; in Bavaria, eleven and seven-tenths miles of road per 1,000 acres. As a general average Dr. Schenck gives for Central Europe, one mile of road for every 200 acres. Water

transportation of logs is apparently more common in Europe than in America, and railroad transportation much less common. Recognizing this difference in major transportation method and recognizing also that economic and social conditions in Europe and the eastern portion of the United States are much different from ours, yet it may be instructive to note what some prominent foresters say on the relation of roads to forest management. Gayer says: "Forest roads are undoubtedly the best means of land transportation of forest material and good forest management must attend strictly to the necessity of intersecting forests with good roads. The chief reason for preference of roads to other modes of timber transport depends on their superior durability." Incidentally, on the question of road standards, Gayer gives eighteen feet to twenty-four feet as the proper width of main forest roads and for subsidiary roads ten feet to fourteen feet. For gradient he gives 5 per cent for main roads, with 7 per cent or 8 per cent permissible for subsidiary roads, and 10 per cent or more if loads are to be hauled down hill only. The following quotation from Roth will serve to bring out the high lights of his thought on the subject:

> The basis for a road system is profitable use; there must be something to haul and the road must make hauling more effective and economical. Generally the value of a road system as part of development of a forest property has been underrated. And this is as true of the forests of the old world as of our own country. Thousands of acres of forest in the Tyrol, in the Southern Alps of France are, today, inaccessible and have practically no income. In the Great Lakes district conditions for years have been such that the putting back on the land of one dollar per acre would have developed a road system, and with it a forest division and protection and closer utilization which would have made these forest properties well-paying business enterprises and would have changed the attitude of the people toward them, and resulted in more satisfactory taxation and protection. The same is true in part of the Southern pinery. Here a rapid growth, easy and cheap logging and proximity to market are sure to develop a most intensive practice with regular thinning and artificial reproduction. If some of the income in cutting the virgin stand is put back on the land in reproduction and roads, the property is ready for continuous intensive work. Without this development of the roads, there is either long delay in proper income or else a sudden demand for large sums for roads; both unsatisfactory.
>
> The same principles apply everywhere; good site, rapid growth and fair topography will justify road-development; poor, cold or dry sites, box canyons, rock slide and cliff situations for long distances, necessarily hinder. In more remote and difficult situations it is often better to defer building roads and get on with trails. In this case it is of value to locate the trail at once on a wagon road grade, and allow the trail to develop into a road if need be.

Schenck, in his "Forest Utilization," says:

> It is evident that the amount of money to be invested on roads is con-

trolled by forest-financial considerations: That sum of money must be spent for road building which will bring the investments made (soil, timber, farms, mines, orchards) to the highest state of relative productiveness, with the result that the highest and safest annual surplus dividend is secured from the aggregate investment.

A road system must be so planned and built that it increases the value of the forest estate by more than the actual cost of the road. A road system is often meant to last for a number of years. For that reason it is necessary to anticipate, when building it, the requirements of the future.

The writer will accept the statement of these authorities insofar as they applied to the forests that were under management at the time the statements were made, and try only to draw a corollary between them and conditions as they exist in the western United States, and particularly in the Inland Empire.

At the outset it may be observed that nowhere in America has there been, until recent years, thought of anything but what Dr. Schenck has termed "destructive" forestry in the harvesting of timber from private lands. The harvester of the virgin stand has thought only of cutting the trees, portions of which could be removed at a profit. There has been no thought of going back to the land for a second harvest ever. Consequently, roads and other improvements have been designed to serve most economically his immediate needs. Since the lumberman did not expect to come back to the land, it would have been folly for him to spend any more money for improvements than was necessary to make them last through his operation. The purchaser of national forest timber has had the same desire in its harvesting that he has had in harvesting privately owned stumpage. Namely, to take out everything that could be removed at a profit, and leave behind everything else. That is a matter of economic necessity with the lumberman since timber products from government land must compete in the open market with similar products from private land. Any additional costs of production designed to bring about "conservative" rather than "destructive" forestry must obviously be borne by the land owner. The Forest Service has consistently assumed for the government the extra cost of manufacture occasioned by such silvicultural practices as it saw fit to impose, in its effort to place the national forest land on a conservative management basis. It has, through such measures as slash disposal, removal of diseased trees, felling of snags, saving of young growth and seed trees and trees that have not yet reached commercial maturity, assumed in behalf of Uncle Sam, the land owner, heavy burdens of cost designed to make the land produce its maximum of values in forest

products. Probably nowhere has the expense incurred per acre been as large on account of these items as in the white pine type of District One. The item of slash disposal alone has cost in the neighborhood of $25 per acre for the land of this type cut over in the district. But we have in the white pine type spent in addition to these items another very large sum for the removal of inferior species that could not be handled by the lumberman except on a subsidy basis. The average cut per acre of mixed species during the last few years is apparently around 5,000 feet and the average loss per thousand charged off against white pine stumpage is around $7 per M, indicating an investment of something like $351 per acre as a silvicultural measure designed to open up the stand and provide optimum conditions for white pine reproduction. Some question has been raised as to how much of this is a paper loss only and how much is real. That it is real is indicated by the following figures showing the spread between mill run prices for white pine and mill run prices for larch and fir, during the last your years. The spread in 1923 was $30; in 1924 it was $21; in 1925 it was $21; in 1926 it was $20; the average is $23. The cost for manufacture of white pine is about $5.50 per M. more than for the four years of $17.50 and an average price of $10.50 for white pine if the mixed is figured at minus $7. Seemingly then we have spent in the neighborhood of from $50 to $60 per acre on the white pine type cut-over for silvicultural and protection purposes. How much have we spent for permanent roads or permanent improvements of other kinds? During the last few years we have required the construction of three railroads as a condition of sale of timber. The largest of these projects was for opening up the Burnt Cabin chance on the Coeur d'Alene. An allowance of $400,000 was made in the appraisal for cost of this railroad, but as conditions existed between competitive bidders, the government seemingly got as much for the timber after stipulating that the railroad be built as it would have had it been sold without that stipulation.

The construction of a railroad was required on the Eagle Creek chance, but it was constructed at a cost not in excess of a flume which the operator had proposed to put in. He was persuaded that the railroad would not cost more than the flume and consequently it may be figured that the same price was received for the stumpage. The railroad into the Big Creek chance on the Coeur d'Alene cost $52,500 against the stumpage. The timber would otherwise have been driven. It may be said, then, that the district has expended a very little indeed out of stumpage to secure permanent improvements to

date. And yet Schenck says that "Conservative forestry is more a matter of transportation than of botany." Gayer says, "Good forest management must attend strictly to the necessity of intersecting forests with good roads." Roth says, "If some of the income in cutting the virgin stand is put back on the land in reproduction and roads, the property is ready for continuous intensive work."

But this is not intended as an argument that our silviculturists have been wrong. The purpose of the above statements has been to point out what has been expended for silviculture, or botany, as Dr. Schenck terms it, as against what has been expended for permanent roads which, he says, are the more necessary for conservative forestry, and it is, of course, conservative forestry that we are attempting to bring about. Whether or not it would have been wise to have expended less money for silviculture and more for roads is, of course, a debatable question, but it seems obvious that we would be in a much better position to carry on continuous operation on the areas with the system of permanent railroads, truck roads and perhaps chutes and flumes that could have been put in with the money that has been expended for the removal of the inferior species and without lowering the standards that have been followed in the removal of slash, diseased trees and snags. The money expended for removal of mixed species would have been enough to build a mile of road for every 200 acres of this cut-over land, equaling the average that Schenck gives for Central Europe. It is conceivable that these improvements would have made possible the removal of much of the unprofitable mixed stand soon enough that a white pine stand could still have been secured. As an indication of possibilities along this line, the following excerpt is taken from Webb's appraisal on the Eagle Creek chance:

> The entire chance should be put up in one unit and an effort made to justify a logging railroad up Eagle Creek. Owing to the large amount of larch and Douglas fir in the drainage which may be later removed for stull for the Coeur d'Alene mines, the white fir suitable for pulp wood and the poorer stands of more inaccessible white pine remaining, a railroad will be of much value in future work and if this sale is made to a small outfit, such as the Mountain Lumber Company, spreading the cut over seven or eight years, much of the additional mixed timber may prove profitable to remove at the end of that time.

That Webb's prophecy was not a wild one is shown by the fact that though the report was written in 1924 and the original sale is yet to run five years, the operator has already opened negotiations toward securing the mixed timber that lies farther back at a price of $1.50 per M.

The silvicultural practice that the district has followed in the white pine type has had as its objective, as we all know, the opening of the stand to secure a second crop of white pine. Investigations that have been carried on have demonstrated pretty conclusively that this would be brought about much more slowly, if at all, without a pretty complete opening of the stand. Assuming, however, that the practice has been the best and that the stands should have been cut as they have been cut, there is still a possibility that an adequate system of permanent roads paid for out of a portion of the first stumpage receipts would have been a good investment; with such a system of roads that would make the maximum distance from tree to road one-third of a mile and the average distance one-sixth of a mile, it would seemingly be possible for operators to go on to the area and pick up products that were left behind in the first operation, such as occasional seed trees blown down, cedar products, bug-killed pine, etc. It is entirely conceivable that with adequate road systems over which logging might be done by horse-drawn vehicles, trucks or tractors, and that with either a driveable stream or a logging road leading from the areas to points of manufacture, the "pick-up" on those areas would be sufficient to warrant the maintenance of the road, and it may be pointed out that not all of the cost of the permanent roads need be charged as an extra item against the stumpage, since if they were put in in the first place they would serve in lieu of a large expenditure for temporary improvements that the operators put in in order to remove the first cut.

But all of the forest land in the district or in the region is not white pine type. Much lesser amounts of money have been expended for silviculture in the other types. What would be the possibilities and advantages of permanent roads on cutting areas in the other types? Let us take, for example, the Yellowstone Tie and Timber Company sale on the Madison. Sales have been made within the last six years of 7,600 acres of tie timber on this tract. These sales provide for a cutting of not less than 90 per cent by volume of the stand. It is an area of relatively easy road construction. The operator on this area went in, as in other areas, with the idea of getting all of the useable material he could from it at the time of his operation. The timber sales were made with the idea that future operations are to be conducted on the area, but the rotation period is figured at about sixty years, so the thought was in mind of both operator and forest service men that there would be no purpose in putting in permanent lines of transportation because their maintenance over so long a period as sixty years

would not be warranted by the value that they would have in a future operation. There is much to be said in favor of light cuttings in lodgepole stands. Loss from wind, sunscald and insects is large where heavy thinnings have been made. In good tie stands there are usually abundant trees smaller than tie size to furnish the basis of a second or even a third or fourth harvest. Light cuttings may result in the site being taken by spruce or fir reproduction. It is entirely likely that that will happen even after the heavier thinnings such as have been made. And if it does happen, the resulting forest stand may be more valuable than the lodgepole. If I were handling such an area to make it produce its maximum of timber I would want to make light cuttings at frequent intervals. I would not, for example, want to cut a two-tie tree this year which, if allowed to let stand ten, fifteen or twenty years, would develop into a three-tie tree. But if we are cutting with the idea of not coming back for 60 years, we will take the two-tie trees out because in 60 years they will, perhaps, be too large for tie trees. Suppose that, instead of planning to cut over this whole area in ten years, it had been planned to cut only about one-fourth as fast and remove the amount of material that will be removed in ten years, in a period of 40 years. Would not the forest then produce a materially greater number of trees and could not this be done without a greatly increased cost of operation if permanent roads had been put into the area at the outset, and we had planned to handle the tract in that way? There are, of course, other improvements than roads, but camps and equipment for twenty-five men cost only about one-fourth as much as camps and equipment for one hundred men. On an operation such as this there is a big loss in camps because they are used only for a few years and then abandoned. It does not pay to maintain them until the next time of cutting. If the operation were continued over the forty-year period, smaller camps could be constructed and they could be, practically speaking, in continuous use not only for the forty-year period, but indefinitely. I have not carried this to the extent of attempting to estimate what production could be secured by cutting in this way. It may be that results would not be anything like the picture that I have drawn, but that the possibilities are worth more thought and more study than has been given them, I am convinced. I think it is not unfair to say that the Forest Service has, during the last twenty years, sacrificed some of its ideals as to selection cutting in order to meet the economic requirements of the lumber industry. I am not finding fault with that because silviculture has to meet the test of economic feasi-

bility. But what I am questioning is whether or not we have gone too far over on the side of meeting economic requirements, or rather whether or not the economic requirements might not have been met by less sacrifice in silvicultural principles and more attention to permanent improvements.

There is another phase of road construction in connection with exploitation of timber resources that it is worth while to touch on briefly, and that is the necessity or the desirability of roads for purposes of importing men and supplies into principal camps even though the roads are not to be used for timber transport. Fairly careful estimates as to quantity of equipment, tools, food supplies and feed required for a logging operation in the Inland Empire indicate that for every M. feet of timber removed, it is necessary to transport into the camps seventy-five pounds of equipment, food and feed. For every million feet, then 75,000 pounds, or thirty-seven and one-half tons, are required. This can be transported by truck at an approximate cost of twenty-five cents per ton mile and by pack train at an approximate cost of $4 per ton mile, indicating that for every million feet of timber cut it is economy to spend $140 per mile for road construction rather than to take the material in by pack train. To bring this out more clearly let us assume a logging chance of fifty million feet, the camps for which will be ten miles beyond the end of truck transportation. It will pay the operator to spend $70,000 to construct a road rather than to pack in his supplies. It is evident, I think, that no major operation depending on water transport of logs can be carried on economically without the construction of a road. Even where a chance is operated by a logging railroad, there are a great many advantages in having a parallel truck road. Although toting can be done more economically over the railroad, there are in a measure the same conveniences and social advantages of a road paralleling a logging railroad as of a road paralleling a common carrier railroad, and no one questions any more the necessity of automobile highways paralleling the railroads of the country. Roads will in the future, then, be placed in the forest, first, as a means of transportation across the forest, and, second, as a necessity or a convenience in removing timber products. Is it not entirely possible that it would be a good investment in many places to build them in advance of these needs for the value that they would have in protection?

ROADS FOR PROTECTION PURPOSES

There are no roads into the headquarters of twenty-three district rangers on the Nezperce, Selway, Clearwater, St. Joe, Coeur d'Alene,

Kaniksu and Flathead Forests. Three out of these twenty-three headquarters are on railroads and one can be reached by water transport. The only means of travel or transportation into the other nineteen is by trail over distances varying from five to fifty miles. The area included within these twenty-three ranger districts is slightly over 4,000,000 acres; 2,700,000 acres of it is in one practically solid block in the Nezperce, Selway, Clearwater and St. Joe Forests. Nearly 900,000 acres is in a solid block on the Flathead Forest. Adjoining these areas are large additional tracts with practically no roads in them, although the ranger headquarters are accessible by road. The 3,600,000 acres of land within the four forests in Idaho and the Flathead in Montana boast a total of about fifteen miles of road. There are no roads at all on the one district on the Kaniksu and the two districts on the Coeur d'Alene have not more than fifty miles of useable road. These twenty-three district rangers have the task of protecting 4,000,000 acres of land from fire. They have in all about 240 summer guards, including packers, commissary men, etc., and will have about 375 trail laborers in the region during the 1927 fire season. Four million acres of the roughest mountain country in America, country over which it is impossible, because of rugged topography, brush and down timber, to travel by horse except over trails, and where one mile an hour is good time for a man loaded with pack, unless traveling on trail, and two miles an hour is good time on trail. Fire hazard from human agency is small, but from lightning the hazard is, perhaps, the greatest on the continent; great enough that on approximately one-half million acres there were in the neighborhood of 200 fires started in 1926 by one storm. The extremely dry summer season, the old burns, inflammability of material on the ground everywhere, make fire easiest to start and hardest to stop of any region in the country. We have built trails, many miles of them, and are continuing to build more, but ten miles of road, all of which is in the class of roads "necessary to travel across the forest," will constitute the entire program in these areas for the year ahead. We have a picture then of an area of 4,000,000 acres with a maximum man-power of 640 men, shut off from the rest of the world because of lack of transportation, whom we are unable to assist by more men from the outside except by walking them over trails for distances that may consume as much as four or five days' time. This is the force that is in practice available to give protection to an area greater than the total land surface of the states of Rhode Island and Connecticut and these men can travel only on foot and their tools, food

supplies and camp equipage can be transported only by pack animals, which cannot find sufficient feed in the region to subsist on so that a goodly portion of the feed for the stock itself must be transported over the many miles of trails. Yet with this organization, the ideal has been set up of keeping acreage loss to one-tenth of 1 per cent per year. Is it surprising that no such ideal has been accomplished and is it any more than commonsense to say that its accomplishment is not in sight with the means of transportation that are available? Would it be surprising if a forest officer, responsible for realizing such an ideal, should find himself looking back in his family tree to see if he could discover that one Don Quixote was its principal branch? The objective in fire control is, of course, to get a man on every fire in the shortest possible time after the fire starts. Elapsed time and not proximity to the fire is the essence of this ideal. It doesn't matter whether the man starts from a point one mile or twenty miles distant, provided only that he gets there promptly. One man can stop any fire if he is there soon enough, but if he is a little bit late, two men are twice as good as one and ten men are ten times as good. So long as men travel only on foot, one man who is located even a mile farther away than another, will be a long time behind the first. If he travels by car, he need be only two or three minutes behind. In other words, a man fifteen miles away from a fire with a motor vehicle to travel in is as close to the fire in elapsed time as a man only one mile away who travels on foot. What do we need most? More men to travel slowly or transportation facilities by which the men we now have can travel rapidly? Obviously, either will help. The problem is to get the right measure of each.

Drawing conclusion from the picture, it has seemed to me that perhaps possibilities lie more in the direction of more rapid travel than they do in bigger protection forces. Obviously we have plenty of men in the woods to put out all the fires that are likely to happen if they could get to the fires promptly. I have attempted to make a little study to determine what might be accomplished in first line defense by road construction, on an area of approximately 90,000 acres on the St. Joe. There are now two lookouts and six smokechasers. A four-hour control is considered established. By the construction of forty miles of road at an estimated cost of $160,000, one man with a car would have a three-hour control. With the road system in, the area could be put within four-hour control of ten or a dozen men who might be assembled at any time in the town of Avery. There may be much difference of opinion as to which method would be calculated to give

the best protection, but to my mind two men equipped with cars and with access to a bigger number of men who could be brought in when more men are needed, would furnish a better protection system than we now have. Savings made through employing fewer men would be ample to cover maintenance of the road and of the special equipment that would be necessary. There would, of course, be some additional hazard on account of the roads, but this can be met through closing the roads to travel during the danger period if control of travelers and reasonable patrol is insufficient. The investment would, of course, be large, yet it is less than $2.00 per acre for the area and the road system would serve other purposes from the start and would ultimately be of value in exploitation of the timber resource.

As a further test of the possible desirability of roads for protection, I have secured from men familiar with the area, an estimate of the cost of constructing a usable road along the divide between the Clark Fork and Priest River on the Kaniksu. Eighteen protection men, lookouts and smokechasers could be connected along this divide by a road approximately forty miles in length. A pretty good road could be constructed for $200,000. A narrow road suitable for motorcycle travel could be constructed for possibly $60,000. Such a project would allow rapid transport of the men from one end to the other along the backbone of the Kaniksu Forest. Instead of each man being isolated so far as protection of his particular territory is concerned, one or two or for that matter all of the other men could follow right behind him if they were not engaged with fire in their own districts. Given one fire at a time, two smokechasers along this divide with a road to travel over could reach the fire in as short a time on the average as it is now possible with the whole number. Such a road could be connected at two or three different points with side roads that are now almost to the divide. Additional men could be brought in in the same way as was illustrated in the example above. The value of a road such as this built along a divide would, of course, be much less for other than protection purposes than roads up the valleys that will serve for transportation of men and materials into the forests as well as timber products out of the forest. Here, as in the St. Joe case, it seems possible that better protection would be afforded with the fewer number of men, or for that matter, in both cases the men employed on the maintenance of a road could be kept on the job during the fire season and be available for fire duty. In other words, with the road in it could be maintained by the same number of men now employed, the difference being that some of

them would be on road maintenance duty, or they would be on road maintenance duty during that period when the fire hazard is low and they would all be available for smokechasing when needed. Two hundred thousand dollars is a considerable sum, but it is, after all, only about forty cents an acre for the Kaniksu Forest. A motorcycle road that would allow rapid transit of men but that would not be as valuable for transportation of equipment, could be constructed at a very much smaller figure. Probably there will not be much disagreement regarding the desirability of such projects as these from a protection standpoint. The question that will be raised is, how soon with the amounts of money now available should we begin to put in developments of this kind in lieu of more extensive trail systems? My own judgment is that both are needed, but it is now time to rush forward more rapidly travel-way projects that will allow of transport of both men and equipment by motor vehicles even at the sacrifice of material slowing up of our trail construction program.

Another little study as to the efficacy of roads in protection has been made on the Lake District of the Coeur d'Alene Forest. This district comprises a total of 142,000 acres, including a considerable territory under co-operative protection, not inside of the forest boundary. Its force consists of a ranger and alternate at Coeur d'Alene, four combination lookout-firemen, and two patrolmen. There were thirteen lightning fires in the district during the 1926 season. For eleven of these fires the data is sufficient to show action by use of roads as against action without roads. The ranger or his alternate went from Coeur d'Alene to the majority of the fires and smokechasers proceeded on foot from their locations to most of them. The average elapsed time by the men traveling from Coeur d'Alene by car was one hour, fifty minutes. The average elapsed time of the smokechaser was three hours, twenty minutes. The average distance to fire from Coeur d'Alene was twenty-one miles by car and one and seven-tenths miles by foot travel. The average distance traveled by smokechaser was four and five-tenths miles. The average speed for car travel is apparently about twenty-five miles per hour and for foot travel about one and five-tenths miles per hour. The location of the fires in 1926 was such as to give more than ordinary advantage to the men traveling by car because there were fewer fires than would ordinarily be the case out of this number in the higher country that is nearer to the lookout firemen's stations. Over a period of years the elapsed time for men traveling by car from Coeur d'Alene to the lightning fires would probably

be greater than in 1926 and the elapsed time of smokechasers traveling on foot from their stations, be less. However, the men traveling by car from Coeur d'Alene had the advantage of one and one-half hours on the average in 1926, and considering the extra mileage that could be made from the end of roads in that time, it is believed that over a period of years with the present roads and the present organization, men traveling by car will continue to show a shorter average elapsed time to lightning fires than will the smokechaser traveling by foot. On each of two days, three lightning fires were reported on the district within a short time of each other. On one of these days the fires were distributed in smokechasers' districts. On that occasion more prompt action was possible through having smokechasers distributed in the numbers that were on the district than would have been possible with one man traveling out of Coeur d'Alene. On the other day that three fires were reported they were all in one smokechaser district and we were not nearly as well off at having the number of men as we would have been with one man at Coeur d'Alene, because the man who went out by car was able to reach these fires within an average elapsed time of one hour, while the average elapsed time for the smokechaser would have been more than three hours. There was an additional very large advantage in going to these three fires via road from Coeur d'Alene in that the district ranger went himself and secured additional men so that he had enough force to handle all three fires. It is, of course, dangerous to draw conclusions from such a brief and piece-meal study, but if results of this study may be taken as an indication of the possibilities, it seems that so far as putting out lightning fires is concerned the Forest Service could do a better job with two men at Coeur d'Alene than it could with the six men who must travel on foot, distributed over the region. It is, however, true that four of the six men are combination lookouts and smokechasers and probably could not be dispensed with because of the need for them as lookouts.

If man-caused fires were included in the study the advantage in elapsed time by a man at Coeur d'Alene traveling by car would be considerably greater. The study is perhaps not worth much except to point out by specific example the very obvious advantage of roads as a means of supplying rapid transit and for mobility of men. From the travel time figures it appears that a man traveling by car is about seventeen and one-half times as fast as a man traveling on foot, so that a man thirty-five miles away that he can reach by automobile travel is as close in elapsed time to the fire as one two miles away who must

travel on foot. The obvious disadvantage in attempting to protect large areas with small numbers of men is that in the extreme season when most of the damage is done more fires are set within a region than the men available can handle. Given several fires in each of a number of smokechaser districts and every man will be busy with fires in his own territory and therefore unable to help his neighbor regardless of how fast he might travel. Also, regardless of how fast an individual may travel, it takes time to put the fire out when he gets there and he cannot, therefore, move rapidly from one fire to another. Numerous fires at one time clearly require numerous men. This is, perhaps, the greatest difficulty under the present scheme. When more fires happen in a region than there are men available, some of them get away and regardless of how fast they had traveled, a few men would have been unable to cope with the situation such as existed on the Kaniksu in 1926. Question will be asked, "Where would you be with more roads and fewer men, or for that matter, more roads and the same number of men, in such a situation as happened on the Sullivan Lake district on the Kaniksu, where seventy-five fires scattered well over the district were set by one storm?" "What would happen then?" Possibly a suitable answer would be, "What did happen as it was?" or for that matter, "What would happen with more trails and the same number of men?" Probably no western forest has ever been as well fortified with men as the Kaniksu was in 1926. The total record of protection force, a district ranger and sixteen summer assistants of all classes, was as ample as is provided in any similar country. The force had been built up through training of men in trail and road crews and additional emergency men until the district ranger figured that he had thirty-five men reasonably competent to go out by themselves and find fires. In addition he had in the district 150 men in organized trail, road and logging crews. A total of 185 men, well balanced and of the best type available. Fire danger in the Sullivan Lake district is not much greater than in the rest of the North Idaho forests and to have had men per acre corresponding to those in this district in the national forests of North Idaho would have required more than 6,000 men. The remainder of the Kaniksu was comparably well supplied with men in relation to the number of fires set by the storm of July 13 and 14. To provide a comparable number of men for the bad fire region in Montana would require a total of 12,000 in North Idaho and Western Montana, an obviously unobtainable number. We might divide it by two in order to make generous allowance for the extra slash hazard on the

Kaniksu and yet have a number so large that it would pay to have roads to save time in taking them in and out and to supply them while there. And yet the forces on the Kaniksu were unable to prevent a catastrophe. There were only one-half enough. To be sure, they didn't have an intensive trail system. That would have helped greatly, but would it have enabled that especially large number of men to have gotten on top of the job? I do not think so. Outside help would still have been needed. We took 5,000 fire fighters from the outside into the Kaniksu and yet we did not take in enough. The Kaniksu is, in comparison with other forests, relatively well supplied with roads. A railroad and a good automobile road border it on the south and west. A good road and boat travel provide travel way well up through the center of it. There are branch roads. No part of the forest is more than twenty miles by trail from road or boat transportation. What would have happened had such a storm hit the Clearwater? It would have been humanly impossible to put 6,000 men into the back country. The point that I hope to make here is that it is not reasonable to expect that there will be enough men in the immediate region to put out all fires in the extreme condition without some of them getting so large that outside crews must be employed. When that happens the value of the road is apparent.

It will, perhaps, be pointed out that some of the big fires of 1926 were accessible by roads and yet they got big. There are two things that should be remembered in this connection. The first is that such roads as there are in the national forests are at the lower elevations, through territory that represents the worst hazard because it dries out more than does the country at the higher elevations. The second is that existing roads are largely those through territory that has been wholly or partly logged and that the fire hazard has been very materially increased as a result of these operations. This must of necessity make the fires harder to control.

In closing this I want to repeat that the statements made with reference to silvicultural policy are not intended either as a criticism of that policy or to arouse discussion of the silvicultural methods. It has been used only to illustrate that we have spent large sums on silviculture and very small sums on permanent improvements. Neither is the writer prepared to defend every question raised with reference to the value of roads for protection. There are too many unknown quantities and too many debatable situations to warrant one in taking a definite affirmative position on all of the questions raised. The purpose

of the paper has been to raise questions rather than to argue them and the justification for it, if there is one, lies in the hope that it will stimulate study and thought. If it succeeds in doing this it will, to my mind, have served sufficient purpose to warrant its writing.

All specific examples have been taken from the national forests of District One. But if the statements made are applicable to the national forests they are much more applicable to privately owned forests of the region, because the privately owned land is of better quality, easier topography, and in all ways represents greater possibilities for profit through construction of permanent improvements if the forest is to be placed under management.

DECAY AND SEED TREES IN THE DOUGLAS FIR REGION

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The policy of the North Pacific District of leaving decayed trees to serve as seed trees in the Douglas fir type on cut-over areas has been for some time the subject of such repeated comment and question that a detailed statement of the factors dictating this policy seems advisable. Much of the misunderstanding comes from lack of knowledge of conditions in this region on the part of the questioners. Throughout this discussion three things must be kept clearly in view: (1) that leaving decayed trees for seed is practiced only in the typical, even-aged Douglas fir stands west of the summit of the Cascade Mountains and north of the Umpqua-Rogue River divide; (2) that it is applied only to the present overmature stands from 200 to 500 years or more in age; and (3) that the decays under consideration attack the dead heartwood alone and do not encroach upon the living sapwood.

Decay is very prevalent in the overmature stands of Douglas fir which are so abundant throughout this region. While an occasional stand is relatively sound, a loss of 20 per cent from decay is not uncommon, and in certain cases the cull figure may be 50 per cent or even more. Study (1) has shown that this great loss chiefly results from red ring rot, known locally as conk rot, caused by the ring scale fungus (*Trametes pini*). This fungus fruits abundantly so that infected trees usually bear several to many living sporophores. In 169 over-mature Douglas firs with a loss of 45 per cent in merchantable volume from decay, it was found that red ring rot was responsible for 39 per cent, red-brown butt rot caused by the velvet top fungus (*Polyporus schweinitzii*) for 2.5 per cent, brown trunk rot caused by the quinine fungus (*Fomes laricis*) for 2 per cent, and yellow brown top rot caused by the rose-colored Fomes (*Fomes roseus*) for the remaining 1.5 per cent.

Discussions of the influence of the mother tree on seed are sometimes marked by a lack of clarity as to just what is meant by a diseased tree. Trees infected with fungus and phanerogamic parasites that actually kill or deform the roots, branches, twigs, leaves, or the entire tree are certainly diseased and undesirable for seed trees. However, it is questionable if decayed trees with the dead, mechanically support-

ing heartwood alone affected by a fungus are diseased in the true sense when disease is considered as any disturbance of the normal functions of a living tree.

Two objections are invariably offered to leaving decayed trees as seed trees. The first is that such trees will spread decay to the future stand. In the Douglas fir region this objection becomes academic. As long as the present method of clear cutting Douglas fir prevails, future stands will be cut before the trees attain an age at which they become subject to extensive decay even though exposed to infection. It is doubtful if in the future the rotation for Douglas fir will go beyond 100 years except in rare instances, and normally it will probably fall a decade or more below that age. Throughout western Oregon and Washington, stands of second growth Douglas fir up to 100 years old commonly have less than 1 per cent of their merchantable volume destroyed by decay, even though old veterans, survivors of the previous stand, covered with living sporophores releasing myriads of wind-borne, infecting spores are scattered through them, or the young stands are immediately adjacent to badly decayed, overmature stands from which infection can spread at will. Furthermore, the small amount of decay found in these second growth stands is mostly red-brown butt rot entering through fire scars rather than red ring rot entering through dead branch stubs and knots which is responsible for most of the decay in overmature trees.

It may be that planted stands of the future will have an appreciable loss from decay at a much earlier age than the present naturally reproduced second growth. European experience points to this, with severe losses occurring in stands 60 years old or even less. However, it is to be hoped that our Douglas fir stands of the future will be naturally reproduced, since placing the Douglas fir region on a clear-cutting and planting basis, knowing the high susceptibility of planted stands in other regions to disease and insect attack, as compared with naturally reproduced stands, should be undertaken only if all other means fail. The method for reproducing the future stands when the forests of this region are brought under regulation has not yet been carefully considered. There has been and is so much to work out in order to handle the present overmature stands properly to insure adequate stocking on cut-over land that the more distant problem must be neglected for the present.

The second objection is that seedlings from seed produced by these decayed trees will be below average in thrift. This can be determined only by a long-time experiment, comparing the growth of progeny

from decayed trees with those from sound trees from the same location and of the same age and degree of vigor. This has not yet been done. Willis and Hofmann (2, p. 158) have shown a slightly decreased growth on seedlings from decayed (conky) mother trees as compared to those from normal trees, but this is based on measurements for only the first two years' growth in the nursery beds. It is not impossible that when such an investigation is carried through, no difference will be found in the seed from decayed and sound trees of equal vigor because the decays in Douglas fir confine themselves to the dead heartwood and it may be that no influence is exercised on the vital functions of the tree. Of course, in opposition to this idea remains the fact that of two trees of equal age and size standing side by side, one can be completely decayed and the other entirely sound. If we refuse to attribute this difference entirely to the chances of infection, then the sound tree must be credited with resistance to decay and this resistance must be either inherent in the heartwood from the time it changed from sapwood, or living portions of the tree must have an intangible influence on the dead heartwood.

Furthermore, Douglas fir reproduction on cut-over land must come from seed stored in the forest floor for a few years previous to cutting, from scattered seed trees left after cutting, from seed dropped by the trees just previous to logging, or by seeding in from the adjacent uncut stand. This problem is now under investigation by the Pacific Northwest Forest Experiment Station, and present belief is that on the whole the last three methods are the most important. Scattered seed trees alone would not reproduce an area quickly unless their numbers were large, nor exclusively unless other sources were lacking. Granting these premises, then, if the original stand contains decayed trees, seedlings from this seed source that cannot be regulated will form a proportionate part of the future stand in spite of anything that can be done. Even if it did appear that the progeny of decayed trees was of poor quality, there is always the possibility that the cones on sound seed trees that are left will be cross fertilized by pollen from decayed trees growing on the adjoining tract. The areas of continuous, absolutely clear-cut tracts are not large enough to preclude the introduction from the outside either of spores of the wood-destroying fungi or of pollen of infected trees.

If sound seed trees are left a large proportion of them will not survive to the next rotation. Some will be killed by the slash fire following logging, others will be windthrown, and some will die slowly from the severe shock of sudden exposure by the removal of the sur-

rounding stand. This loss will normally far more than offset the increase in volume through growth of the survivors. Furthermore, the space occupied by seed trees in this region of abundant soil moisture is not so important, since reproduction will grow very close to the base of scattered, overmature trees.

On private lands, leaving decayed trees serves a double purpose. It permits the operator to reduce his logging costs by leaving trees which will yield no lumber and serve for seed trees where the land is held for future timber growth. It must be remembered that on such lands the choice must be made between decayed seed trees or no seed trees, for the private owner is not convinced that timber growing will pay sufficiently to warrant a capital investment in sound seed trees. Furthermore, some operators will leave decayed trees under any circumstances to avoid the cost of felling them and without any intention of reserving seed trees.

When Douglas fir occurs in uneven-aged mixed stands as in eastern Washington and eastern and southern Oregon, an entirely different silvicultural system must be followed. Here the modified selection system as now practiced leaves, after cutting, a number of trees which will have passed the age at which they are liable to extensive decay before the next cutting cycle is reached. It follows then that all trees with extensive decay at the time of cutting, and particularly those bearing sporophores, whether partially or completely unmerchantable, should be removed to prevent their spreading decay and causing loss to the future stand. Aside from pathological considerations, such specimens demand removal, since these worthless trees will occupy valuable space in an, at best, partially stocked stand, while the suppressing effect of large trees on the surrounding reproduction, particularly of the most valuable species, western yellow pine, is only too apparent in this generally dry region where root competition for moisture is particularly severe.

The same wood-destroying fungi are important in western yellow pine, sugar pine, lodgepole pine, Douglas fir, and western larch, and it must be assumed until proven otherwise that the same decay from one tree species is capable of infecting all the other species. Consequently, when these species grow in mixture, it is necessary to remove all decayed trees in order to protect any one or all of the species. On the other hand, the Indian paint fungus (*Echinodontium tinctorium*) causing stringy brown rot so wide-spread and serious in white fir and western hemlock does not attack any of the foregoing, except in rare instances Douglas fir, while the fungus (*Polyporus amarus*) causing dry-

rot of incense cedar is confined to that host alone. Consequently, if absolutely necessary, decayed white firs and incense cedars can be left without danger to other species, realizing, of course, that they occupy space that would be valuable for thrifty young growing stock and that they increase the percentage of the less desirable species in reproduction.

It is essential that decayed trees be eliminated from our stands as rapidly as possible, but occasions may arise when exceptions may seem desirable in which the leaving of such trees may be a logical temporary practice. Such an exception to the general principles seems justifiable in the Douglas fir region of the Pacific Northwest during the period of transition from virgin, overmature stands to regulated second growth.

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(2) Willis, C. P., and Hofmann, J. V. 1915. A study of Douglas fir seed. In *Proc. Soc. Am. For.*, v. 10, no. 2, pp. 141-164, April.

ABNORMALITIES IN ANNUAL RINGS RESULTING FROM FIRES

By F. C. Craighead

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Some time ago, in making observations on permanent sample plots laid out for forest insect studies, it became evident that very characteristic and marked effects in ring growth followed certain types of forest fires. These malformations of growth are a result of defoliation, and are in many ways similar to effects already described for several leaf-feeding insects. Although sufficient time has not elapsed to obtain a complete story from trees of which the fire history is known, it was thought worth while to call attention more specifically to some of these abnormalities already noted in the hope that others, with more material available, will be encouraged to carry the studies further. There seem to be no discussions in our literature specifically dealing with the effects here described.

The specimens selected for illustration are western yellow pines from a permanent sample plot of the Division of Forest Insects, located at Northfork, California. A fire occurred in June, 1924, and a few days later the trees were tagged and scarred by Messrs. Miller and Person and the writer. Many of these trees were killed outright, others were defoliated to varying degrees. The three figures reproduced show three degrees of ring retardation. The figures are all on the same scale and magnified ten diameters. In all specimens, growth for that season apparently stopped at the time of the fire. The small band of summer wood may have formed later, but, since the 1926 ring shows some summer wood on July 1, it is quite probable that that of 1924 had formed by the time of the fire in June.

Figure A was taken from a rapidly growing black jack receiving slight defoliation. The subsequent effects of the defoliation are very narrow summer wood in 1924 and a narrow ring in 1925 which has a nearly normal amount of summer wood. Apparently normal growth will result in 1926.

Figure B was taken from a thrifty tree severely defoliated. The effects of defoliation are narrow summer wood the year of the fire,


A
B
C
1923
1923
1923

reduced growth in 1925 with scarcely any summer wood, and only a trace of wood formed by July 1, 1926. It is evident that this tree has not yet recovered normal vigor.

Figure C was taken from a thrifty tree which was much more severely defoliated than the preceding. In this case only a trace of wood has formed after the fire. It cannot be determined whether this represents 1925 or 1926 growth. There is still some doubt as to whether this tree will live, though vigorous growth in the terminal suggests recovery. In case it does, some rings will be missing on the lower stem.

A complete picture of the effects of this fire cannot be obtained until normal growth is resumed—possibly 3 to 5 years later. These examples, however, will serve to illustrate the striking effects of defoliation by fire. Observations on marked trees in California and North Carolina have already gone far enough to indicate that some of the resulting abnormalities in ring growth due to fire are missing rings on the lower stem (to date two years' wood has failed to form on certain shortleaf pines in North Carolina), narrow rings with narrow summer wood, and so-called false rings (formed only on a portion of the circumference). On that part of the stem within the crown these effects are less pronounced, and wood may be forming here while completely absent on the lower stem.

It is obvious that these abnormalities will materially effect studies based on ring growth, or studies based on accurate identification of certain rings. With the frequent fires of the coastal plain types it is quite possible that in a 100-year stand as many as 10 years' wood may be lacking on some trees. This may be an explanation of the apparent discrepancy in ages of individuals in even-aged stands. It may also be that so-called false rings are more frequently a result of fire or insect defoliation than of climatic conditions, to which they are usually attributed.

No doubt some of the readers of this note will be in a position accurately to date older fires and obtain a more complete picture than is given here. This is difficult because of possible absence of rings, but it can be done if an easily identified very wide or narrow ring precedes the fire, such as the 1923 ring in these specimens. The method of identification used here was to remove a small square of bark immediately after the fire, from which point all subsequent growth on the same plane was identified.

Comments by E. N. Munns*

It is interesting to note that your work substantiates some studies of ring growth made a number of years ago in California. On a large number of trees which were thoroughly sectionized and analyzed for evidence of decay, it was found that fire scars occurred as far back as in the early 1600's. When the date of these fire scars was followed it was found that in some cases there would be a spread of 3 or 4 years over which the fire occurred. Inasmuch as the trees in a very restricted area all showed these various dates, it was assumed that there was an error in the ring count which caused the dispersion. A check, however, of the work indicated that it was so carefully done this would not account for the spread, and hence it was assumed that lightning fires occurred over a period of several summers causing fires which scarred some trees and not others.

Your work shows that the absence of rings may be due to severe scorching and hence while the ring count would be correct, the year in which the fire occurred might be off, due to the lack of definite rings during the spring subsequent to the fire.

While I do not have the data available now, I recall that in the year 1832 we found that the fires ran from 1831 to 1835, being spread over the entire period with a peak coming about 1832. The dropping out of rings due to fires at later dates would result in an error of two or three years, which would make about 1832 the critical year in which the fire occurred. The tendency, of course, would be to throw the dates of the fires farther back so as to make the fires occur earlier than the fire scars would indicate them.

A study such as the one you have outlined shows also the inadvisability of depending too strongly upon dates as indicated by fire scars for actual dates, as in law cases and the like.

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*The writer asked Mr. Munns to read this manuscript. His comments were of so much interest that I asked his permission to have them follow my article.

MEASURING TREE HEIGHTS ON SLOPES

BY RICHARD E. MCARDLE AND ROY A. CHAPMAN

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In connection with a certain study of yield of Douglas fir, certain difficulties were experienced in measuring heights of trees based on horizontal measurements. The use of a slope measurement instead of horizontal measurement greatly facilitated the work in this particular case, by lessening the work of measurements and by making it possible to measure trees below the observer, it being an advantage to measure trees from a point higher up the slope owing to the trees being more readily visible and shorter basal distance being required.

Various methods were tried; one based on table of slope corrections gave satisfactory results. The second, and the most successful, method involved the use of a specially designed slide rule.* Briefly, this method provides for measuring angles at any convenient surface distance and, with one setting of the slide rule, the total height of the tree is read. An objection to this method was that the slide rule is graduated in degrees; practically all field work with the Abney level is in percentages rather than degrees. Nor can the Forest Service hypsometer be used in connection with the slide rule, because the hypsometer is graduated in percentages. It is, therefore, desirable that the slide rule also be graduated in percentages instead of degrees. Theoretically it is possible to do this, but the mechanical difficulties of graduation are such as to make the method impractical. So that although this method was found to be helpful if an Abney level graduated in degrees could be used, it still was necessary to find some system which would enable the use of per cent Abney levels and the Forest Service hypsometer with slope measurements in measuring tree heights. A graphical method which will fit the requirements is outlined below. This method was devised for those who are obliged to use percentage scales.

As illustrated in Figure 1, 100 feet of surface distance was taken as a constant and, using various slope angles with various angles to the top, the corresponding tree heights were calculated by these formulæ:

* Haig, I. T.: "Short Cuts in Measuring Tree Heights." JOUR. FOR., XXIII, 11 Nov., 1925. Pp. 941-944.

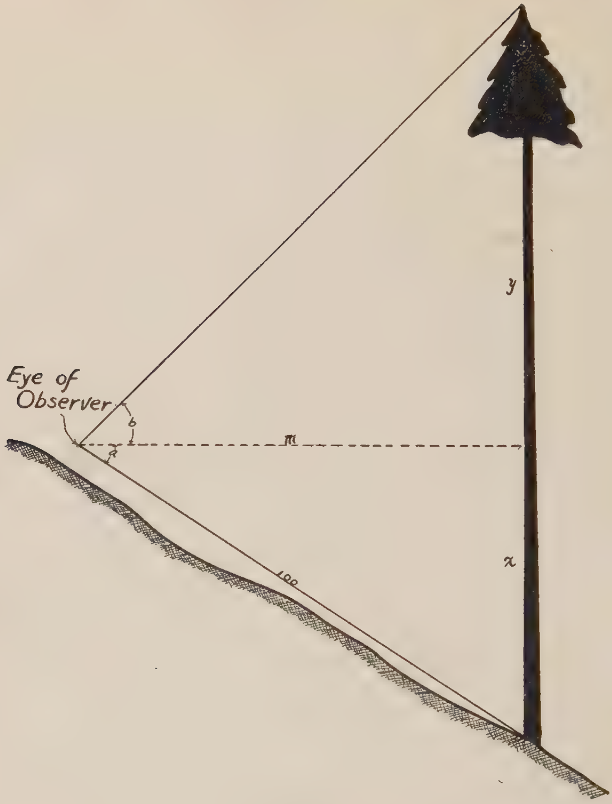

FIG. 1

$$\text{Sin a} = \frac{x}{100} \text{ or, } x = 100 \text{ Sin a}$$

$$\text{Cos a} = \frac{m}{100} \text{ or, } m = 100 \text{ Cos a}$$

$$\text{Tan b} = \frac{y}{m} \text{ or, } y = m \text{ Tan b}$$

$$\text{Height of tree} = x + y$$

$$\text{Height} = 100 \text{ Sin a} + m \text{ Tan b}$$

$$= 100 \text{ Sin a} + 100 \text{ Cos a Tan b}$$

Tree heights were computed for each of the following sets of angles: 10, 20, 30, 40, 50, 75 and 100 per cent to the base of the tree, and for each of the above, angles of 10, 20, 30, 40, 50, 75, 100, 125, 150, 175 and 200 per cent to the tip. In this way were obtained the seven heights shown in Table 1.

TABLE 1.

BASIC FIGURES USED IN CONSTRUCTION OF GRAPH SHOWN IN FIGURE 2. BASED ON A SLOPE DISTANCE OF 100 FEET

Angle to base in per cent	Angle to tip (in per cent)										
	10	20	30	40	50	75	100	125	150	175	200
	Height of tree (in feet)										
10	19.9	29.8	39.8	49.7	59.4	84.5	109.4	134.3	159.2	184.1	208.9
20	29.4	39.2	49.0	58.8	68.4	93.2	117.7	142.2	166.7	191.3	215.8
30	38.3	47.9	57.5	67.0	76.3	100.6	124.5	148.5	172.5	196.4	220.4
40	47.4	55.7	65.0	74.3	83.3	106.8	130.0	153.2	176.5	199.7	222.9
50	53.5	62.4	71.4	80.3	89.0	111.7	134.1	156.5	178.9	201.3	223.7
75	68.0	76.0	84.0	92.0	99.7	120.0	140.0	160.0	180.0		
100	77.8	84.8	91.9	99.0	105.9	123.7	141.4				

These basic figures were plotted on cross-section paper. Curved lines were drawn through the points representing each separate angle to the tip and intermediate lines were drawn between these principal lines. The result was the simple graph in three variables shown in Figure 2. As given here the chart is devised for use when the observer is above the base of the tree to be measured. This chart can easily be extended, however, for use also when the observer is looking up, instead of down, the slope. This extension is accomplished by the formula:

$$\begin{aligned}\text{Height} &= y - x \\ &= 100 \cos a \operatorname{Tan} b - 100 \operatorname{Sin} a\end{aligned}$$

To use this graph, the observer stands at any convenient distance from the tree to be measured, but preferably at some even multiple of 100, as for example, 50 feet, 70 feet, 100 feet, or 125 feet. This, of course, is surface measurement. With the hypsometer, the angle to the base of the tree is obtained, and also the angle to the top of the tree.

(If the base of the tree cannot be seen, the observer's assistant marks the lowest point whoch can be seen and the distance from this point to the base of the tree is later added to the height obtained by the ob-

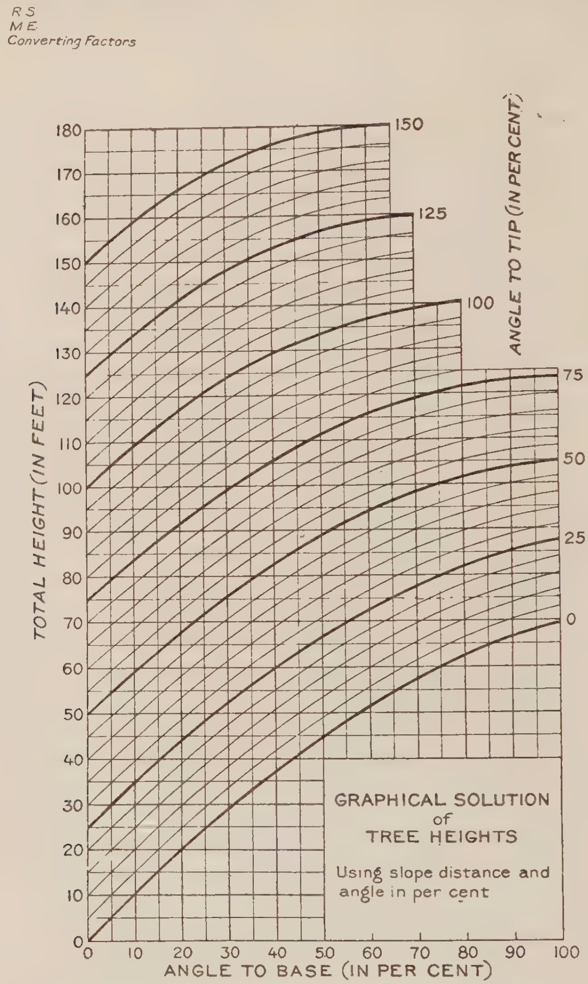

FIG. 2

server.) On the graph, locate along the bottom edge the angle to the base of the tree, follow this line upward to the point where it crosses the curved line corresponding to the angle to the tip of the tree. Opposite this point on the left hand edge of the graph will be found

the total height of the tree. As the construction of this graph is based on a surface-measured distance of 100, the corrected height—if the observer is not at exactly 100 feet, surface measurement, from the tree—can readily be computed. Thus, if the observer finds the total height of the tree to be 100 feet and if he is standing 100 feet (surface measurement) from the tree, no correction is necessary; if the observer is 50 feet from the tree, the true height of the tree is .5 of the height as read, or 50 feet. In other words, the graph is used exactly as the hypsometer is used on level ground for distances more or less than 100 feet.

In common with all other similar methods, this scheme has its advantages and disadvantages. The chief advantages of the method are that it makes possible the use of slope measurement with a hypsometer graduated in percentages. Another very decided advantage is that the angles do not have to be added—simply measure the angles to the base and to the tip of the tree. There are no parts to get out of adjustment, and the graph is small enough to carry in the field notebook. The chief disadvantage of this graphic method is that the tree heights must be corrected unless the observer stands at 100 feet from the tree. Although these corrections are so simple that they may be computed mentally, there probably is some danger of error, but as the same error is present when horizontal distances of less or more than 100 feet are used, this perhaps should not be considered a disadvantage peculiar to this method alone. Aside from this, there is the possibility of straying from the graduated lines and so reading an incorrect height. This is not a serious objection, but should be kept in mind when using the graph. All things considered, this graphical method of obtaining tree heights, using slope distances, should effect a considerable saving in time without any appreciable loss of accuracy.

THE MARGINAL DITCH AND SWAMP DRAINAGE FOR FORESTRY

By A. E. Wackerman

Lake States Forest Experiment Station

A "marginal ditch" as it is called, usually surrounds northern swamps where they come in contact with upland, mineral soil. This ditch is a depression in the peat from ten to twenty feet wide at the edge of the swamp in which free water frequently stands and which supports a distinct type of vegetation which thus rings the swamp and isolates it from the upland. This vegetation of the marginal ditch is often alder in the case of well-developed swamp forests of spruce, tamarack, and cedar, but frequently it is made up of sedges and other aquatics.

In nearly all stages of lake filling, the marginal ditch is present from the time the sedge-mat has grounded and the swamp forest has obtained a foothold to the stage when the peat swamp is entirely covered with swamp forest. The illustration from Davis[3] showing in cross section a partly-filled lake is a typical example of the "marginal ditch or foss."

This phenomenon has been observed by several writers who have endeavored to explain its presence. Atkinson[1] accounts for the marginal ditch by the shading of the edge of the bog or swamp by the upland trees, and the rapid and luxuriant growth of plants which become established fifteen to twenty feet from shore shutting off the shallow water. Cooper[2] in his study of the climax forest of Isle Royale is also inclined to accept this explanation. Davis[3] believes that the marginal foss, as he calls it, is caused by fluctuations in the water level of the swamp during rather brief intervals and their constant recurrence. During the wet periods, according to Davis, hydrophytic vegetation becomes established while during the dry period it is killed and more mesophytic plants take over the ditch. These are in turn killed when the water rises. These fluctuations of the water level

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[1] Atkinson, G. F. 1898. *Elementary Botany*, pp. 386-7.

[2] Cooper, W. S. 1913. The climax forest of Isle Royale, Lake Superior, and its development. *Botan. Gaz.* Vol. 40, Nos. 1, 2, 3.

[3] Davis, C. A. 1907. Peat; essays on its origin, uses, and distribution. *Report of the Michigan State Board of Geological Survey.* (1906.)

prevents either group from becoming permanently established and normal succession from taking place, and also aids the decomposition of the plant remains.

MacMillan[4] observed sphagnum atolls in certain small lakes and accounted for them, primarily, by a gradually lowered water level followed by a subsequent rapid rise. Sphagnum atolls, however, such as MacMillan describes are rare and are not typical swamps with marginal ditches.

Fire is suggested by Pennington[5] as the cause of the ditches and Shaw[6] describes them as being caused by leaves from the highland washing into the edge of the swamp and smothering any plants growing there, leaving open water.

Of the above reasons for the marginal ditches, the one offered by Davis seems the most plausible. But even his account does not seem to thoroughly explain the marginal ditch. It is true that changes in the water level such as he describes would alternately favor different ecological associations. But such changes would affect similarly the whole swamp vegetation except the floating mat which would rise and fall with the water level, so this explanation does not seem to be conclusive.

A study of northern swamp forests is being undertaken by the Lake States Forest Experiment Station and one of the important phases of this study is to devise methods of properly draining swamps so as to improve their forest growth. This means that a system of artificial ditches must be established to remove the excess water.

In studying swamps in the field with a view to their improvement, the author has almost invariably observed the "marginal ditch" and it occurs to him to account for it in a way not mentioned in any of the swamp literature which he has so far read.

The water in swamps comes, in most cases, from seepage and surface run-off from the high land and this must enter the swamp at its margin. This water, besides containing considerable oxygen, must carry with it soil in suspension and minerals in solution and probably is nearly always warmer than the swamp soil. Also it may carry

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[4] MacMillan, C. 1894. On the occurrence of sphagnum atolls in central Minnesota. *Geological and Natural History Survey of Minnesota.* Bull. 9. pt. 1.

[5] Pennington, L. H. 1906. Plant distribution at Mud Lake. *Report Michigan Academy of Sciences.* Vol. VIII.

[6] Shaw, C. H. 1902. The development of vegetation in the morainal depressions of the vicinity of Woods Hole. *Botanical Gazette,* Vol. 33, page 437.

with it soil bacteria and fungi and thus the border of the swamp would be continually inoculated with organisms of decay.

These conditions would favor a more rapid decomposition of the peat and plant remains at the borders of swamps than in the swamp proper, causing a decrease in the bulk of the peat and a consequent settling of the soil. This would result in the marginal ditch. The more complete decomposition of the peat in the marginal ditch was well demonstrated during the ditching of a small swamp in the Minnesota National Forest for experimental purposes in forest swamp drainage. Firm, undecomposed peat in the swamp proper allowed rather steep slopes at the sides of the ditches. At the border of the swamp in the marginal ditch, however, the peat was so swell decomposed and

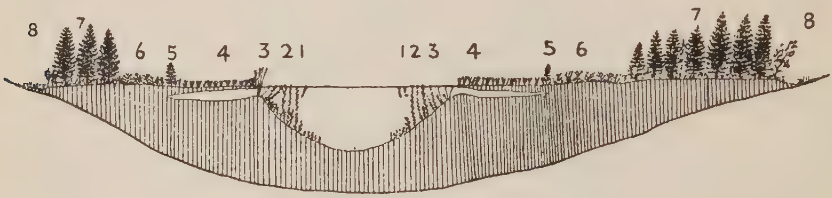

FIG. 1. Diagram showing how plants fill depressions from the sides and top.

Legend to FIG. 1.
1. Zone of Chara and floating aquatics.
2. Zone of Potamogetons.
3. Zone of Water Lilies.
4. Floating Sedge mat.
5. Advance plants of conifers and shrubs.
6. Shrub and Sphagnum zone.
7. Zone of Tamarack and Spruce.
8. Marginal Fosse.

disintegrated that the ditches had to be made much wider than in the rest of the swamp, and the slopes of the ditch had to be made much more gradual.

Because there is no appreciable flow of water in bogs, muskegs, and most swamps, the seepage water and run-off from the upland probably remains at the margin indefinitely, filtering into the swamp itself only slowly and only after the minerals, bacteria, and oxygen carried by it have been dissipated at the edge of the swamp.

The problem of the cause of the marginal ditch assumes practical importance when we begin to consider methods of ditching peat swamps to secure their proper drainage for soil improvement. In developing the engineering features of swamp drainage, interception ditches have

been extensively used, particularly in Sweden and Finland where the drainage of swamp forests is a common cultural practice in forestry. Interception ditches are dug around the borders of a swamp to cut off the flow of water into it and central ditches are dug to remove the water from the swamp itself. These are sound engineering principles in swamp drainage.

But if the margin of the swamp is benefited to the extent of decomposition of the raw peat by the upland run-off and seepage waters, as seems to be evidenced by the more thorough decomposition of the peat and plant remains in the marginal ditch, is it necessary or even wise to cut off from the swamp its only source of mineral nutrient materials? Especially is this an important question when we consider that the swamp forests of tamarack, black spruce, and cedar such as are found in the Lake states may not need so much the drying up of the swamp as the free circulation of water.

Center ditches with laterals would remove the excess water from the center of the swamp and cause a circulation of water from the margins of the swamp towards the ditches. This would cause the seepage and run-off water from the margins to come gradually into contact with the peat throughout the whole swamp and bring to it the benefits that the peat soil of the marginal ditch enjoys in the undrained swamp, i.e., conditions favorable for decomposition.

If, however, the marginal ditch is not caused by the better decomposition of plant remains brought about primarily by the upland seepage and run-off, there would be no benefit to the swamp as a whole to circulate this water through it, and interception ditches might be from the biological as well as from the engineering point of view, the best means of draining swamps to improve their forest growth.

Drainage of forest swamps to be practical must be as cheap as possible and the minimum amount of ditching necessary to bring about the desired benefits is what is sought in forest ditching. Therefore, if the cause of the marginal ditch can be established, it may aid in solving the problem of how to drain our forest swamps to improve their growth at the least cost.

THE DISTRIBUTION LIMITS OF THE LONG-LEAF PINE AND THEIR POSSIBLE EXTENSION

By H. Ness

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As the collections and classifications of the species, which constitute the flora of a given region become completed, the collectors and systematists turn their attention more and more to the physiological causes of the make-up of the plant colonies, or associations, in each region. In many cases these causes are easily found, because they are self-evident. In other cases they are so puzzling that mere observation of the natural occurrences will not reveal them; direct experimentation, under which all factors are known and understood, must be resorted to.

The confinement of the long-leaf pine to a certain class of soil, seems to me, fits in the latter category. Dr. Sargent describes its geographical distribution and the soil of its habitat in his *Manual of Trees of North America* as follows:

"Generally confined to a belt of late tertiary sands and gravels, stretching along the coast of the Atlantic and Gulf States, and rarely more than 125 miles wide, from southern Virginia to Cape Canaveral and the shores of Tampa Bay, Florida, and along the Gulf Coast to the uplands east of the Mississippi River, to the valley of the Trinity River and through the eastern part of Texas, and the western part of Louisiana nearly to the northern border of that state."

In his *Report on the Forests of North America,* published by the Census Office in 1884, the same author gives a map showing the distribution of the pine forest in Texas. The area inhabited by the long-leaf pine is indicated as an ellipsoid, with its longer diameter extended from Orange County in the South into Panola County in the North, having the Sabine River as its eastern border. Its greatest width, or shorter diameter, extends from that river to a line passing a few miles into Trinity County.

Traveling in East Texas from the region typical of the short-leaf pine and deciduous hardwoods to that of the long-leaf pine, one is struck with the change, both in the contour of the land, and the character of the soil. From the decidedly rolling land with a more or less intensely red soil, one passes into an area which is more level in contour with a grayish, sandy surface soil, underlaid by a pale, yellowish, or

mottled clay loam. This soil is evidently much poorer than that of the short-leaf pine and hardwood region, since many forms of vegetation bear evidence to that effect. Especially do the cultivated plants, such as cotton and corn, show the lack of fertility. The absence of humus from the light colored, sandy upland soil, and the absence of the long-leaf pine from the darker, loamy soils of the lower situations in this region are quite noticeable to any observer. This change in the color and texture of the soil is coincident with a change in the population of the forest from a stand of nearly solid long-leaf pines, on the upland soil, to one of the loblolly pine mixed with hardwoods on the soil with more humus. The number of species on the latter increases in direct proportion to the humus content of the soil; but a sprinkling of loblolly pine is generally within sight, even on the pure alluvium skirting the water courses and subject to occasional overflows.

The conclusion seems natural, on the part of anyone noticing this restricted distribution of the long-leaf pine, that it cannot exist on soils containing a fair amount of humus. Its dense stand and luxuriant growth on the sterile upland sands seems also to testify to its abhorrence of a better soil. Certainly, large quantities of seed have fallen during every "seed-year" on the adjacent richer soil, but one will look in vain for any long-leaf pine trees resulting from such sowing.

The nature of the soil and general condition of growth in the long-leaf pine forests of the other states, whether on the Gulf or Atlantic coast, match closely those in Texas. Roland Parker gives the following description in his *Economic Botany of Alabama* p. 113: "Geology and Soil.—The oldest strata exposed in this region are mottled clays and coarse, loamy, cross-bedded sands with various shades of pink, yellow, purple, etc."

EXPERIMENTS ON A DIFFERENT SOIL

Before having had the opportunity to observe the long-leaf pine in its native habitat, I made strenuous attempts to grow a plot of it in the arboretum of the Experiment Station at College Station.

The surface soil of this place is a rather tight, clay loam, eight to ten inches deep, with enough organic matter in it to give it a decidedly dark color. This is underlaid by a gray, almost impervious subsoil—therefore, quite different from the soil of the long-leaf pine forests, the subsoil of which is moderately porous. The first specimen of this pine was planted in 1917. It was one of a few survivors of many seedlings from the same sowing. It was two years old from the

seed at the time of planting, having passed the first year in a pot, and the second in the nursery ground. It had made, in that time, a long tapering, unbranched tap root, but no visible growth above the ground, except a cluster of vividly green leaves. Together with this single long-leaf pine, specimens of nearly a dozen other species of pines were planted. All of these soon proved failures, because of the ravages of a shoot-boring larva, which every year destroyed the growth as fast as it was made. The long-leaf pine, on the other hand, escaped and grew with such vigor, that I determined to give all the ground occupied by the failures to plants of this species alone.

For that purpose, I sowed more seed of the long-leaf pine and prepared to raise them in the same manner as I had raised the seedlings of other conifers, including several species of pines. My method was to sow the seeds in flat boxes, in a soil made up of leaf mold and fine sand, so as to give it a texture of mellow loam. In about ten days after sowing, germination commenced, and simultaneously with it the damping-off of the seedlings. In spite of careful watering, the disease continued for many many months, no plant being safe until it had acquired well-advanced adult leaves, that is, leaves in fascicles,—a stage reached by comparatively few of them. These few were then transplanted into five-inch pots, where they appeared to do well, until the roots were stopped in their downward growth by the bottoms of the pots. Then, the leaves began to lose their bright, green color, turning gradually to a pale yellow. A few more were lost before the conditions for transplanting into an open field became suitable. A still larger number died after transplanting, in spite of all nursing, because too much weakened in the pot culture. A smaller number changed gradually from the dull, pale color of their leaves to a vivid green and at the same time grew more leaves. The stem remained without increase in length for at least two more years, at the end of which time it had, however, increased greatly in thickness. But the most remarkable growth was the formation of a large, fuzzy, terminal bud, about three-fourths of an inch in diameter. When these preparations were completed, this bud, so to speak, burst into growth, making a shoot three to four feet long before the end of the season.

To replant the vacancies and complete the plat, more seed was sown during two succeeding seasons in soil of similar composition, but subjected for several months to various sterilizing processes before sowing. The success was not perceptibly better, only a few additional plants were obtained in each year. The next sowing was made in pure

builder's sand, mixed with enough pure clay to make it retentive of moisture. This practically reversed the results; no larger percentage died than that which had survived on the soil containing a fair amount of organic matter. But owing to lack of proper nursery facilities, the plants were pot-grown in the second year. This produced weaklings, many of which succumbed after transplanting into the field. To replant the resulting vacancies, new plants were obtained in 1925 through the generosity of Mr. J. K. Johnson, Forester of the Southern Lumber Company, Bogalusa, Louisiana. These were handsome, vigorous plants, apparently two years old and nursery-grown on their native soil. After waiting for rain, which failed to come, the planting had to be done on too dry soil, because of the lateness of the season. Again, as a consequence, more than half were lost. The next year, 1926, the same experiment was repeated, with the same kind of nursery stock, from the same locality, but obtained from the Southern Forest Experiment Station, and with similar results for similar reasons. The survivors of both of these plantings are at the present writing (March 4, 1927) so vigorous that a strong shoot may be expected from each one before the end of this season.

The resulting vacancies of the plat were replanted during the early part of February, 1927, with one-year-old plants, nursery-grown on the State Forestry Station at Kirbyville.

During my visit of last September to that place, I became particularly interested in the little nursery of four or five species of pines, raised for experiments in reforestation of the cut-over lands at Kirbyville.

The seed had been sown broadcast, during the preceding winter or spring, on slightly elevated beds, having a width of about six feet. The ground was gently sloping, and the soil was of the typical, grayish, sandy loam, apparently free from humus, but otherwise of a texture and tilth suitable for a seed bed. The stand on the bed of the long-leaf pine was perfect, and so dense and intensely green as to make it appear, from a distance, like a bed of heavily-stooling, young and vigorous oats. The beds of the other species showed a much thinner and more irregular stand. The plants were much less thrifty and would, on that account, need one or two more years before reaching the size and vigor, which the long-leaf seedlings had attained in one year. In short, the seedlings of these other species had all the signs of plants dwarfed through lack of nourishment.

GROWTH IN THE ARBORETUM AT COLLEGE STATION

The difficulties experienced in securing at once a full stand of long-leaf pine (a little over a hundred plants) in the above-mentioned plat, were due to lack of knowledge of the nature of the soil as well as other conditions of growth in its native habitat. These same difficulties can be avoided easily by anyone making the attempt to grow the long-leaf pine, after having read these notes.

No individual of this species has, after starting growth, died on our grounds, but all have continued with very uniform and apparently increasing vigor each year. Those of the first planting (1921) have now attained a height of ten to twelve feet, with a thickness of shoots and vigor in foliage, excelling any of their kind of a similar age noticed at Kirbyville. Out of fifty species of trees planted in our arboretum, the long-leaf pine showed the least distress during the severe drought of 1925, the Italian cypress being next best. The long-leaf pine has not shown itself subject to any insect or fungus pest on our ground, while the Italian cypress is subject to attacks of the red spider, and a few have succumbed to what appears to be a fungus disease.

CONCLUSIONS

From the above described experiments and observations, I am led to the following conclusions in regard to the long-leaf pine:

(1) It is an inhabitant of sandy or clayey loams very poor in organic matter; not because this is a necessity for its growth, but because its seedlings perish from damping-off during early infancy if germination takes place on a soil containing a perceptible amount of humus.

(2) When nursery-grown on its native soil, or on a soil of similar constituency, it can safely be transplanted at the age of one or two years into a soil of a different character.

(3) When transplanted into a soil with a fair amount of humus it shows its appreciation of the increase in fertility by an increase in its growth.

(4) Its adaptability to extremes in soil moisture is very great; it is, therefore, probable that when grown and transplanted, as indicated above, it may also be adapted to a great variety of soils.

(5) Because of its striking beauty and magnificent size, the long-leaf pine would be unexcelled by any native evergreen for park

planting in a large part of Texas, being suitable both singly on lawns and in dense groups imitating its native groves.

(6) Because of its frugality with respect to soils, its rapid growth, and the immense value of its timber, the long-leaf pine would make an excellent tree for planting in farm forests. It may be grown on land too poor for crops or grazing, such as on old, abandoned fields, of which Brazos County alone has thousands of acres. Properly started and cared for in such places for a few years after starting, it would be a source of perennial increase in value of property otherwise constantly declining in value.

THE ART OF TEACHING

A PROFESSIONAL PROBLEM*

Mulford's article in the November, 1925, JOURNAL OF FORESTRY touching on the problems of the profession—past, present and future—has been a subject for much thought on my part, as well as on that of most other foresters. Since that article appeared, I have attempted frequently to stand off in an objective manner so as to gain a perspective of the forestry profession and all of it sproblems, and of all the factors bearing on these problems. In every case, my thoughts came to focus gradually upon a single problem. My purpose in writing this comment is to stimulate fresh thought concerning this problem which seems to me to dig down to the very roots of the profession; namely, that of the initial training of the young forester.

Some time ago, a certain project led me to consult two very important authorities for advice and orientation on several points. Both are scientists in a similar field. *A* is a teacher and well-known author —*B* is an equally well-known author and lecturer. I had hoped for much help from each.

After approaching *A* I gave him, to the best of my ability, a background of my project. I then mentioned that I needed orientation in the treatment of certain aspects within his special field so as most effectively to deal with cause and effect. It was a vain effort. Rather, the story of my specialty, forestry, was so new and absorbing to *A* that I became the dispenser rather than the receiver of information and enlightenment. When I attempted to get back to the purpose of my visit, the reaction was vague. There didn't appear to be anything which would just apply—no, but he would suggest that I make an appointment with *C*. I went away greatly depressed, for perhaps I could not make these points unless I should abandon everything else and devote all of my time for quite a period to research on this one angle of my main problem. In other words I should be sidetracked, for my time was limited very definitely. What could *B* do?

B received me with quiet cordiality. My story was interrupted often by questions and by assuring recollections on his part of the problems in his field on which it threw some light. At the finish,

* The author, out of a sense of modesty, prefers to remain anonymous.

emphasis was placed upon the necessity of keeping certain points continually in mind. The development which I had in mind, and my references, were weighed carefully in the background of his experience, and there were many suggestions to aid me in bringing out findings which already were mine. I went away with these suggestions, a good list of references and an invitation for the review of my work at a later stage of its development. But, most important of all, I went away in a tremendously happy state of mind and with a feeling of inspiration.

A and *B* are equally well-known and respected authorities. *A* is a teacher by title but not by nature. *B* is not a teacher by title but he is eminently one by nature. The forestry profession must keep before itself, always, this fundamental truth—that there are good and poor teachers, whether they be born that way or not—and the effect of this truth upon its future development.

The inductive method has become the very basis of modern pedagogy, both in higher as well as in lower education. Knowledge (yes —and wisdom) can be acquired most easily by proceeding, not from the general to the specific, but by starting with the specific and enlarging into the whole field; by selecting the germ of a truth or a condition and helping it to grow and grow until its tentacles reach out into an all-encompassing grasp. The young forester should receive his basic technical training on one *working* forest, be this forest large or not so large, in order that he may be able to watch the shaping of each acquired fact into a highly intelligible, classified whole. It is difficult for the young forester to feel the life-throb of unrelated, unclassified ecological facts, or to hear the saw ring on a text-book fact of silviculture.

The true object of art is the *particular* which contains the *universal.** The *universal* in forestry is the forest, elevated to its proper place in the economic and social life of the State. The art of forestry is, when reduced to its essence, the *act of elevation* of the forest to this position. The only *particular* which we have of this sort is the *working forest.* For this added reason, the young or so-called embryo forester should not be turned out into the profession until he has had intimate contact with such a forest. But this implies a still broader element in his training.

The young forester must not be sensitive only to the throbbing of the inanimate world of plant life. He should be conscious of the

* Schopenhauer.

greater field of ecology—the world of *homo sapiens* and of the place of forestry in this. This bandying about of the words "service," "ideals," and "vision" by members of the Zenith Rotary and Athletic Clubs is all part of the evolution of Zenith. But sometime someone in Zenith must be the first to fall on these words and burst them, to squash the wind from them and pick among the remains for the reality which lies hidden within. What do they mean?

I do not intend to enlarge upon these words, for they cannot be grasped by mere definitions. They are elusive. But, having been snatched first to one extreme by bland optimism with its rhapsodic sightlessness, and then to the other by pessimism with its pitiful self-contradictions, I have begun to realize the power which a *teacher* holds of obscuring or clarifying their reality in the mind of the student. Only when they have become a part of the wisdom of the teacher can the germ of their appreciation be engendered in the mind of the student forester. When this is the case, they will color his explanations and arguments; they will creep out in the humor and thoughtful optimism of his words. True artist—the teacher will then be to forestry *un grand distributeur de vie,* a great life-giver.

And those forest schools whose teachers are so equipped mentally and materially, now and in the future, will have helped solve, indirectly, yet another great problem—one which faces every profession: namely, that of the sustained attraction of the best minds of the ever-rising generation.

WHAT CAN EUROPE TEACH US IN FORESTRY?

By P. W. Ayres

Forester, New Hampshire Protective Association

Foresters in America have had some general notions of what European forests can teach us. We have known that the forests in Europe have been under management for a long time; that they are carefully tended; that they are profitable, sometimes yielding dividends to the inhabitants of small villages; that the dense population creates market conditions quite dissimilar to our own, because of which foresters abroad are enabled to employ methods that are quite out of the question with us. Our impression has been that owing to widely different conditions, Europe has few lessons of great value in our practice; that American woods are peculiar to themselves; and that we must develop our own methods from our own experience.

While some of this may be true, it is very far from the truth. To a careful observer, European forests teach lessons of profound significance. Such questions are involved as the relation of successive tree crops to the productivity of the soil, the relation of the State to private forests, acquisition of forest land, problems of forest insurance and forest taxation, drainage, fixation of blowing sand, control of floods and torrents, insect depredations, forestry instruction, and the education of the people in understanding the importance and the significance of the forest. These are a few of the questions at this moment vital in our American forest practice. It is foolish to neglect the long and rich experience of our alert and intelligent fellow foresters abroad.

The principles of forest soil preservation are being worked out in European experience through several rotations of forest crops; to work these out from our own experience must take several generations of tree growth, and may lead us at length, perhaps through suffering, to conclusions that European foresters have already attained. Let us avoid the stupid mistake of self-efficiency.

In a general way species, soil, and climatic conditions in Europe are comparable to those in America, but in most of the countries in Europe the primeval forest has been absent during a series of rotations, or several hundred years. In Italy, where the woods and fields appear

to have been under continuous productivity for the longest period, some of the primeval woods may still be traced in inaccessible places. Most of them were removed at least five hundred years ago. It is reported that when Machiavelli (1469-1527) was out of a job with the European princes, he retired to his estate in the mountains, and for a livelihood cut off the original forest. It is this longer practice in regeneration of the forest under conditions relatively similar to our own, that makes European experience significant to us. We are at the threshold that Europe crossed long ago. It is in the succession of forest crops, and their relation to the soil, that European experience is especially valuable to American foresters. In America we follow blithely in our new enthusiasm for reforestation, methods which European foresters are beginning seriously to question.

A brief review of some of the forest conditions in European countries will illustrate some of these important principles more clearly.

GREAT BRITAIN

Our nearest neighbors in Europe are the English, nearest in language, communications, and method of thought. The primeval forest in England disappeared long, long ago. As population grew, agriculture appropriated practically all of the better soils. As English manufacture developed, especially textile manufacture, grazing seized upon large areas of the less desirable soils to the exclusion of the woods. England has demonstrated the relation of grazing to forestry—the lamb has eaten up the wolf, and there are no forests. As grazing rights have become hereditary and transferable, they have not permitted the forests to return. The same is true in parts of France and of Germany. In our own West we are meeting this problem on a large scale for the first time, and we must take care as a Nation, that areas especially within the National Forests are not encroached upon by cattle and sheep raisers who now ask long term rights on public property, and would secure tranferable rights if permitted.[1]

With the development of English supremacy at sea, it was discovered that timber could be imported from the Colonies or from other

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[1] See the articles by Mr. P. L. Buttrick, Secretary of the Connecticut Forestry Association, in JOURNAL OF FORESTRY (Vol. XXIV, Pg. 141) and in *American Forests and Forest Life* (March to July, 1926). See also the Stanfield Grazing Bill (S. 2584) and the important hearings before the Senate Committee on Public Lands and Surveys.

countries, especially from Scandinavia, cheaper than it could be produced at home. For nearly a century this practice appeared to be fully justified; but during the recent World War, a great awakening in forestry took place. While her people were hungry, and her ships were disappearing rapidly day by day, England had to import boards instead of food, in order to ship arms and ammunition from her factories to her sons in France. Mine props had to be imported in order to maintain the output of coal.

Hardly had the War ended, before the English people revived with a will the program of reforestation, which prior to the War had been regarded as too expensive. Earlier inventories had disclosed large areas of idle land throughout the United Kingdom.[2]

In the face of enormous post-war obligations Parliament passed the Forestry Act of 1919, appropriating 3,500,000 pounds sterling (approximately $17,500,000), with which in a period of ten years to acquire and plant 200,000 acres, or about 312 square miles, which, it is believed, will provide the nation with needed wood material in time of emergency, for a period of three years. The fifth annual report, for 1924, shows that the Commissioners have acquired 141,700 acres, of which 42,082 acres have been planted.[3]

Some doubt exists as to whether or not the appropriation will be renewed in 1929. The Treasury is very hard pressed. Trade has not fully recovered. Unemployment is still a great burden. With eight years of security since the Armistice, English people are again realizing that importations are cheaper than home production.

FRANCE

Another neighbor, near in historical friendship and in commercial contact, is France. The French system of managing forests is significant to American foresters, partly because it differs from much of our practice, and because it has been on trial long enough to see the results. By and large, it may be said that the French use the selective method in forestry, rather than that of clean cutting and planting. This means usually a forest of mixed species from which mature trees are taken out continuously so that the trees remaining

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[2] 1885 and 1909.

[3] This action is not unlike that of the State of Massachusetts which about the same time (1920) appropriated $3,000,000 with which in fifteen years to acquire and plant 150,000 acres. 88,000 acres have been acquired and about 5000 acres planted.

will have the best opportunity for development. It is the exact opposite of an American lumbering operation, where by the method of "forestal rapine" everything possible is taken at once. French foresters exercise the most painstaking care in their forests, and know beforehand when and why each tree will be taken out, whether at the first cutting or later. Even on plantations that have come to maturity, the French use the selective plan. Through the use of this, during many years, they appear to have discovered for the forest the principle of perpetual youth. Their woods are generally of mixed species, largely hardwoods, especially in central and northern France. Nowhere does one get the suggestion of an exhaustion of forest soil.

By an ancient law, maintained until this day, one-fourth of the total volume has been retained in French forests, as a reserve against emergency. It was this very unusual habit that enabled France to provide all kinds of wood material, railroad ties, piling, dug-out props, building material for cantonments, hospitals, and barracks, all the requirements for three of the greatest armies in history, her own, the British army, and the American, through cruel years, in addition to meeting the fuel and other necessities of her own people. It may be that French forests won the War, and the outcome had been different but for this resource. Moreover, for the most part the normal growing power of the forest was not destroyed. Over-cutting was not the general rule.[5] How we slashed right and left in our American woods.

In two respects, France leads the world in forest practice. These are as follows:

In the first place, France leads in the reclamation of waste land. The sand dunes of western France, and particularly the province of the Landes, between Bordeaux and the Pyranees, were formerly desert country, well pictured in Joseph Conrad's story, "The Rover." They were swampy, malarial, and nearly uninhabited. More than a century ago, the French Government began to reclaim these lands. The swamps were drained and planted, the blowing sands were held, first with grasses, and at length with pine trees. Now the region has become salubrious, dotted with health resorts, and profitable as the chief source of European naval stores, turpentine, etc. The French

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[5] Woolsey says in Studies in French Forestry, (Preface VII), Many forests were clean cut with no satisfactory provision for regulation, and in others the growing stock of saw-log material was so reduced that *"normal" production cannot be secured for a century or more.* Yet it must be recognized that this destructive use of the French forests helped to save her armies."

method of reclaiming waste land is not superior to that of Denmark and the Netherlands, but is on a much larger scale.[6]

The second practice in which France leads is in the control of mountain torrents. Following the French Revolution and the Napoleonic wars, when the new freedom gave to French landowners the privilege that American landowners have always enjoyed, namely, the right to remove the forests from their property at will, the mountain forests were seriously over-cut. This took place to the greatest extent in the Vosges and Jura Mountains. Floods became destructive in the Rhone Valley, not only to agriculture, but also to commerce in the cities and towns. The present cost of flood control in France is excessive almost beyond belief, yet imperative. The work is extensive and costly to maintain. The French Government has expended more than $100,000 in terracing and reforesting a single mountain valley. Any one who travels on railway trains through European countries will realize, in the interest of his personal safety, the necessity of controlling floods at their source.

It is still possible in the United States to prevent the kind of forest destruction on most of our steep mountain slopes that has created such difficulty in France. Whenever the Federal and State Governments have acquired forest on high mountains, as in the National Forests at the West, in the Adirondacks, in the White Mountains and Southern Appalachians, large areas have been set aside solely for protection; but, except where Government ownership has intervened, the common logging practice destroys ruthlessly the forests on the high slopes everywhere. Almost invariably fire follows. This changes profoundly and permanently the character of mountain soil and the growth upon it. Considerable areas in the White Mountains of New Hampshire are barren, due to severe forest fires after cutting. Other areas are so seriously crippled as to require centuries for rcovery. Are we capable of learning from the experience of France?

GERMANY

More than any other people, the Germans have practiced the method of clean cutting followed by planting. An example of thrift, rather common in parts of Germany, is to grow a crop of potatoes

[6] On Cape Cod, and in a few other places, we in America have made some successful, though puny efforts, at reclamation by means of forest planting. If we ever get seriously into this business, as probably in time we must do, the European countries have nearly everything to teach us.

for one or two years after a forest is cut. They are planted in rows between the young trees. The crop furnishes a small sum toward the cost of weeding the plantation, and affords supplies to forest laborers.

Some of the leading foresters in Germany are departing from their long-used method, changing from clean cutting to selective cutting, and from pure stands to mixed stands. The Swiss also are changing. This is highly significant, for in this country our plantations, for the most part, are made up of even age pure stands. With American efficiency, but possibly with short-sighted vision, we plant pine or spruce and sometimes ash in pure stands. The reason underneath this change in Germany, which as yet is observed more in plans for the future than in actual practice, is the discovery that a succession of heavy forest crops removed from the soil exhausts it. Spruce appears to be the worst offender in this respect.

A good example occurs in the forest of the Tharandt Forest School in Saxony. A generation ago, officers in charge had the conviction that to plant spruce in pure stands was the straight and narrow road to profit. Large areas were thus planted. Elaboratae formulæ indicated the rates of growth and of income—on paper. The forest itself has not done very well, having but a moderate growth after seventy or eighty years. The result is that a flourishing forest school, founded by Cotta, the great forest teacher, with a well-equipped faculty and a considerable group of eager, attractive students, finds itself in financial difficulty, seriously short of the expected returns. The area was clean cut before planting.

In places in the Black Forest, efforts are being made to induce Beech to mix, by means of natural regeneration, under Spruce and Silver Fir in order to break up the uniform stands.

In Germany, one is impressed by the apparent contentment in the forest villages. Families have continuous employment, the men in logging, their wives and daughters in nursery work, planting and weeding, and even the children in various light tasks when out of school. This is in marked contrast to our own forest population, where men live apart from their fellows, and like sailor men of old, tend to excesses when liberated. It is not in the woods of Germany that extreme political opinions develop. There is no I.W.W. there.

One observes in Germany, as in most of the other European countries, that forest practice on public land is superior to that on private land. Forty-two per cent of German forests are private.

SWITZERLAND

In self government, and in local independence and initiative, Switzerland is one of our nearest neighbors. Here as in Germany, the new tendency toward a mixed forest and selective cutting is at work. In the admirably managed cantonal forests around Interlaken, Oberforster Otto Müller shows with pride excellent examples of mixed forest, in which all age classes are standing. He shows also pure stands of planted Silver Fir, in the edges of which he is so cutting as to secure natural regeneration of Beech. The reason he gives is to protect the forest soil from degeneration by the removal of successive pure stands.

It was interesting to discover that Swiss foresters, as with us, practice their art when it pays. On all lower slopes, thinnings and dèbris from logging are carefully bundled and sold for fuel. These go down on hand-sleds that are pulled up by the workmen. Market prices for fuel render it possible to continue thinnings to a considerable elevation, but one reaches a point, above which it is unprofitable to thin. From here up Swiss forests, like our own, are left to take care of themselves. At the highest elevations foresters do not attempt to thin, nor even to take out the mature trees, but only to salvage windfalls.

There are Swiss mountain forests that do not yield a direct profit. Like the American Post-office Department, the officers figure out a balanced budget, but really these forests are maintained more or less by taxation, or by profits from other forests. The foresters tell you that these forests protect the soil and the run-off, employ local labor, and supply needed wood material, all of which justifies continued management.

A marked feature in nearly all European countries is the extent to which the Government assists in reforestation of private land. The principle seems to be recognized everywhere that if the Government takes a hand in the regulation of private forests, it must assist in bearing the cost of carrying out the regulations.[7] Private owners do not seem

[7] We are likely to hear more of this in America. Our states provide assistance to private owners in reforestation, and advice as to management. The Clarke-McNary law provides for assistance to farmers in the care of their woodlots and provides seeds and plant material to the States. From advising how a crop of timber should be removed, to how it must be, if on an important watershed, is not a long step. In Switzerland one may not clear his land without permission. In Czechoslovakia cut-over land must be reforested within five years.

to object to the Government regulation of cutting, for the reason that the Government assists generously in re-establishing a new growth. Nowhere is this assistance greater than in Switzerland, where seventy per cent of the cost of reforestation on private land may be borne by the Canton and fifteen additional per cent by the Federal Government.

FINLAND

All of the countries mentioned above are importers of wood. Even Germany and Switzerland do not produce as much as they consume. France is more nearly self-supporting than Germany. Finland[8] exports on a large scale. Russia, Poland, Czechoslovakia, Sweden, and Norway are the other large exporting countries of Europe. Sweden is the largest exporter.

More than ninety per cent of Finland is in forests, swamps, or peat bogs. This is a land of large paper mills and big business corporations, one of which owns 700,000 acres of land, and another more than 1,000,000 acres. Like Canada, Finland grants leases that are transferable. Vast tundras at the north produce very little. Unlike most other European countries, and in marked contrasts to Sweden, Finland permits clearing of private land without hindrance. As with us, there is no legal restrictions on commercial exploitation. As a result, forest fires have rendered serious damage. The practice formerly prevailed of burning over farm land, which after a crop or two, was abandoned, to be later burned again, and farmed, and again abandoned. This intensified the forest fires. Throughout central and southern Europe forest fires are almost unknown. Everything is removed for fuel; but in the coniferous forests of northern Europe, damage from fire is much greater, though never comparable to our conflagrations. Forest fire insurance in Finland has made satisfactory progress since 1916 under two mutual companies. This leads naturally to active preventive work among the landowners.

Finland is in the hey-day of commercialism, and is a large exporter of pulp and paper. A capable Chief Forester directs the Department of Forestry. There is a Forest School in the University of Helsingfors. Five Ranger Schools provide trained under-officers. Churches

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[8] The writer did not accompany Dr. Schenck's party into Finland and Scandinavia. His information is derived from other members of the party who did visit these countries, and from the literature of the subject.

in Finland own more than one half a million acres of forest land, but municipal and rural community forests are not large.

With an intelligent population that has increased three and one-half times in a century, it is to be expected that the Finnish people will be able to meet and to solve their forestry problems.

SWEDEN AND NORWAY

In Sweden, as in Finland, large areas of virgin forest remain. It is estimated that as much as one-half of the original forest is still standing, but in Sweden the annual cut exceeds somewhat the annual growth. This does not appear to disturb the numerous groups of trained foresters who tell you that as soon as their plantations and newly-managed forests come to maturity, the ratio will be changed to a favorable one.

Nowhere in Europe is private land regulated by the State more carefully than in Sweden. Nowhere is the co-operation of private owners with the Government more cordial. The reason for this is not difficult to find. In each province supervision of the forests and enforcement of the laws are given to a board of three commissioners, made up of representatives from the local Forest Service, the local timberland owners' association, and the local Horticultural Society. These determine when private land may be cut, how it may be cut, and when and how it shall be reforested. That the land-owner is represented upon these boards is the significant factor. We have not yet arrived in this country beyond the point of State co-operation with private forests. If in time we have to go further, as many European countries have, co-operative local boards with power, adapted from the Swedish model, may be desirable.

Excessive prices during the World War caused the cutting of much young growth in Sweden. In 1918 a stringent general law was passed forbidding the removal of young growing forests. A remission of excessive taxes will accomplish the same end in some of our American States.

An efficient school of forestry about to attain its one hundredth anniversary (1928) is located at Stockholm. There are eleven Ranger Schools, each of which is equipped with a forest area. Three of these are conducted by large companies primarily to train their own employees.

The Swedish foresters are studying crop rotation and the fitness of the soil for the species to be grown upon it.[9]

In Norway most of the forests are second growth of inferior quality. Unregulated private ownership in the past tells the story. "Wasteful methods and irresponsible care have resulted in depleted and sterile forest land." The State Forestry Department administers the public forest, and supervises the administration of private forests. The selective method is generally used.

When in 1907 Norway separated from Sweden, a great patriotic impulse was turned to reforestation. The army, the school children, and all kinds of associations, caught the spirit. Everybody planted, receiving their plant material from five Government nurseries. This movement appears to have been directed by the Norwegian Forestry Association to which many prominent citizens belong. Here, as in Sweden, and especially in Denmark, the forestry associations have had a real influence in spreading among the people an enthusiasm for forestry that has been reflected in progressive legislation.

Russia

The enormous forest resources of Russia are reported to be hardly touched. They cover two-thirds of the forest area of Europe, yet Dr. Fernow has recorded that one half of the country, and three-fourths of the population are exposed to a dearth of timber.[10] The northern half of Russian forests are still virgin. Probably no one knows how much nor how valuable these assets may be. Two-thirds of all Russian forests belong to the State, and their future is unknown.

ITALY

Italy produces no coal, and its dense population is dependent upon local growth for fuel. The people like insects have attacked the forests. Large portions of the Italian Alps are managed on a fifteen-year rotation for fuel wood. Large parts of the Appenines are similarly treated. The plains of northern Italy are used extensively for the growth of the mulberry tree for silk culture. These trees are cut back severely (pollarded) and yield a valuable by-product in fuel,

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[9] See Edward Beck, Secretary of the Canadian Paper & Pulp Association, Forestry Conditions in Sweden, Finland, Norway, Great Britain, and France, Bulletin 34, October 1921.

[10] History of Forestry, Pg. 258.

as do the extensive olive orchards, and the chestnut orchards that are propagated for nuts. These are estimated to produce six million cords of fuel wood annually. It is said that most Italians never saw a forest. Scattering poplar, ash and elms dot the plains—all pollarded. Every tree has its head cut off, until one wearies at the sight. The mountains are for the most part a miserable brush forest, like millions of acres of our own cut-over lands. No country offers better opportunity to study the evil effects of deforestation in erosion and torrent floods, rivers, flooded in March, are often dry in summer. Grazing has been excessive; not only sheep but many flocks of goats, the worst of all forest pests, have eaten clean the forest floor.

Italy uses very little wood. Like Bulgaria, Great Britain, Holland, Portugal, and Spain it has little. "Poor Spain," as Dr. Fernow used to say has an annual per capita consumption of only 9 cubic feet.[11] Italy's per capita consumption is 15.4 cubic feet as against 299 in Finland, 285 in Canada, and 288 in the United States.

The one oasis in the absence of forests in Italy is Vallambrosa, a forest of 3,000 acres on the mountains thirty miles east of Florence. Here a century and a half ago, a company of monks began the planting of these acres, predominately with Silver Fir. Later they started a forest school. All has now been taken over by the Government. A forest appears to have flourished here at an earlier date because Dante and Milton are reported to have done portions of their work at Vallambrosa. This forest is admirably managed by Government foresters who remove from it large saw-logs, in amount not to exceed the annual growth.

One finds in Italy scattering coniferous forests, as on the Alban hills east of Rome, and along the coasts of central Italy; but Italy is relatively destitute of forests, and unlike England, is unable to import. Mussolini, who fully recognizes the situation, is an ardent patron of forestry and of reforestration. It was at his suggestion that the First International Forestry Congress assembled in Rome in May, 1926.

Lessons

From this bird's-eye view, this sketch, of some of the problems in European forestry, what are some of the lessons for American

[11] In the United States the peak of our per capita consumption occurred in 1907. We used then more than 500 cubic feet per capita. Lumber Cut of the U. S., Bulletin 1119, April, 1923, Pg. 5.

foresters? They may be summed up in the following brief statements:

It is at times dangerous and may be calamitous to depend upon importations.

With the disappearance of primeval forests, the tendency is to limit consumption to local production.

When the State regulates the management of private forest land, it must assist materially in the cost of carrying out those regulations. Because an owner possesses natural forest land, he should not be expected to bear the burden of the community. Private owners in Europe are regulated, but they are also educated.

In the reclamation of waste land and in the regulation of stream flow, European experience is worthy of the closest study.

The relation of grazing to forestry is very clear. Vested grazing rights preclude forest growth.

It is useless to attempt the practice of forestry where it does not pay. Protective forests, even in private ownership, must be a public charge. They pay in indirect benefits.

Forest taxation is based upon forest income.

The people in Europe utilize their waste land. They exercise a National thrift, that is worthy of emulation.

The chief and the most far-reaching lesson that American foresters may learn from European experience, is that in forestry, as in other branches of agriculture, the rotation of crops is necessary to preserve the productivity of the soil. This does not imply clean cutting. On the contrary, it implies that the French system of mixed species, of uneven age classes, and the use of the selective method, preserves the vitality of the soil, whereas successive clean cutting destroys it. The Germans and the Swiss are learning this lesson. American foresters have yet to learn it. The wise forester will conform as closely as possible to Nature's plan.

THE THIRD PAN-PACIFIC SCIENCE CONGRESS UNDER THE AUSPICES OF THE NATIONAL RESEARCH COUNCIL OF JAPAN

By W. C. Lowdermilk

Delegate of the Society of American Foresters

The Third Pan-Pacific Science Congress was held in Japan under the auspices of the National Research Council as guest of the Imperial Government of Japan. The delegates were guests of the Government from October 18 to November 19, 1926, but the business sessions were held in Tokyo from October 30 to November 11, and included the opening session at the Imperial University and the succeeding deliberations in the Imperial Diet Buildings.

The First Pan-Pacific Congress was called by the Pan-Pacific Union in Honolulu in 1920, where about forty delegates from nations bordering the Pacific attended. This congress adjourned *sine die;* no provision for its continuance was made. The objects of the Congress which were "to initiate and promote co-operation in the study of scientific problems relating to the Pacific region, more particularly those affecting the prosperity and well-being of the Pacific peoples and to strengthen the bonds of peace among Pacific peoples by means of promoting a feeling of brotherhood among scientists and through them among citizens in general of all Pacific countries." The sessions at Honolulu were considered by the Australian delegates as worthy of another congress. Australia accordingly invited the scientific organizations of the Pacific nations to send delegates to Australia for the second congress to be held in 1923. At the end of the second congress the National Research Council of Japan, in consideration of the importance of these congresses, was authorized by the Imperial Government to invite the scientific organizations represented at the Second Pan-Pacific Congress to meet in Japan for the third congress in 1926. The invitation was extended by Professor Joji Sakurai, who became President of the Third Congress, at the last session on September 23, 1923. Acceptance was voted unanimously.

On the return of the Japanese delegates to their country, Japan was shocked and bleeding from the enormous catastrophe of the earthquake and fires, whereby Yokahoma was destroyed and Tokyo half de-

stroyed and of nearly 100,000 fatalities. In spite of this calamity the decision to hold the congress in Japan in 1926 was maintained.

The preparations and hospitality which greeted more than 200 overseas delegates on their arrival in Japan inspired the highest praise and commendation. The Japanese scientists had exceeded the most generous expectations in all departments and carried through to successful completion the most notable scientific gathering which has ever met on Pacific shores.

The first intimation of Nippon hospitality was a wireless message received on the high seas by each delegate, "Welcome to our shores, Sakurai." On disembarking at the various ports a representative of the National Research Council greeted and presented us with a preliminary railway pass, which later, on arrival at Tokyo, was exchanged for a general pass—first class—for one month over all the railways of Japan, which are government owned and operated. This pass was again replaced by another through Korea to Mukden for those who desired to make that trip. On arrival at Tokyo we were assigned rooms in the earthquake-proof Imperial Hotel. As soon as we were established in our rooms an armful of packages and literature was presented to each of us, containing PPSC badges, books, coupons to be used for meals, passes on the Tokyo electric lines, and guides to the numerous excursions which were arranged for the delegates. There were also invitations to social affairs such as dinners, Imperial Theater parties, to garden parties and to the Imperial chrysanthemum garden party, the most splendid social event of Japan. Here were evidences of provision for comfort, for entertainment, for honors equivalent to those of ambassadors, which won us immediately.

The business sessions of the Congress extended over a period of thirteen days from October 30 to November 11, but the excursions began on October 18, and following the final session of the Congress, extended to November 19. The first excursion was to Hokkaido which I was unable to take. Our party from Nanking arrived in Tokyo at 6 A.M. October 26 and left at nine o'clock for the excursion to Nikko. Automobiles bearing PPSC pennants took us from the Imperial Hotel to the railway stations. Our host leaders, Doctors Kishinouye, Kusano, Tsuboi and Ando had all arrangements made for special cars for us—a party of about fifty. On our arrival at Nikko cars were waiting to take us to and establish us as guests at the Kanaya Hotel. Thus were we generously provided for throughout the period of the Congress.

On consulting our guide book for Nikko, we found, as we did for all other guide books, that it had been written especially for the Congress delegates by specialists in geology, botany, zoölogy, and history, who had made studies of the region for this purpose. The guide books contained, therefore, information which each specialist would most want to know. The books were beautifully illustrated, provided with good maps, and were attractively printed. Being a forester, the account of the Forest Vegetation by Dr. Shunsuke Kusano was particularly interesting to me.

Before reaching Nikko the railway parallels for about twenty miles the famous cryptomeria (Cryptomeria japonica) avenue, 280 years old. The third Shogun, Iyemitsu of the powerful Tokugawa Shogunate, in building the magnificent mausoleum and sanctuary to commemorate the great achievements of his grandfather, had called on prefectures to supply proportional funds for this splendid memorial. One prefecture being poor made its contribution by planting a twenty mile avenue of Cryptomeria (Sugi) trees. This simple memorial has grown to a most stately and venerable array of giant trees.

The temples, the shrines and Torii of Nikko represent the acme of decorative architectural art, which blends perfectly with the setting of giant awe-inspiring cryptomeria trees. Nikko is a favorite beauty spot with the Japanese and we encountered thousands of public school children in almost continuous excursion parties making the autumnal pilgrimage to this place of refreshing and inspiring beauty.

Beyond the temple grounds bold mountains, with steep walled valleys filled with the rushing roar of clear mountain streams and waterfalls, were aglow with a splendor of color beyond description. It was the time of the autumnal coloring of the maple (Acer palmatum), which features so much in Japanese artistic productions.

The vegetation of this region is representative of the flora of the temperate deciduous hardwood forest, numbering some 200 species of woody plants. In the less disturbed associations the Japanese beech (Fagus sieboldii) was conspicuous. Oaks, chestnuts, hornbeans (two species), maples (three species), magnolias, zelkovas, hazel nut, and other tree species and numerous shrub plants present scenes of lively interest to the forester. Particularly did the prostrate bamboo sasa (Arundinaria chino) attract attention. It forms a very dense covering of the ground, even during moderate shade, and is effective in preventing the natural restocking of forest trees. This plant is a serious

obstacle to natural regeneration of stands and presents a problem in forest management.

The color effects were on a tremendous scale. As a curiosity, I entered in my note book many of the species whose leaves made up the striking color scheme.

The yellows were produced by the leaves of

- Cercidolphyllum japonica (Lemon yellow)
- Kalpanax sp. (Yellow green)
- Acer pictum (Yellow orange)
- Acer craetigifolium (Yellow)
- Larix leptolepis (Golden yellow)

Scarlets by the following species

- Acer palmatum
- Rhododendron obtusum
- Rhododendron kamferi
- Rhododendron spp.

Crimson effects were produced by

- Rhus spp.
- Rhododendron spp.
- Vitis (cerise)

Amber and brown effects by

- Fagus sieboldii (amber)
- Quercus spp. (nut brown)
- Stewartia sp. (brown)

Black green

- Abies holophylla

These colors were woven in the foliage of the mountain slopes as a magnificent piece of tapestry. The moist air softened the more distant scenes in the purplish mist, while near at hand, the clear mountain streams broke into cascades of white water over black stones.

Lake Chuzenji and the Kegon waterfall (330 feet) completed scenes of natural grandeur and beauty.

The return to Tokyo was made on the evening of the second day, October 27. Early the following morning we were off to Hakone, another of the scenic regions of Japan. Our train carried us past Yokohama where substantial buildings are replacing the temporary structures hastily erected after the earthquake and fire of 1923. Automobiles took our party from the Odonara station over an excellent

road which climbed up a narrow gorge to Miyanoshita ensconced in lofty mountain scenery. Hydro-electric plants were noted along the way. Great scars of land slides on the steep slopes were evidence of the vigorous shaking which the region received during the 1923 earthquake. Works of revegetating these landslide scars aroused our admiration for courageous faith and for the technical skill in controlling erosion and in building up a vegetative cover to hold the soil and prevent excessive wash of débris and silt into the mountain streams.

Fujita Hotel, with its waterfalls facing our window and the natural hot water for our baths, will satisfy the most exacting in comfort. The rain did not prevent our visit to the solfatara, a relic of former volcanic activity. The following day a motor trip took us to Lake Hakone after missing a view of Fujiyama because of mist. Extensive coarse grass lands occur in this region. Widespread tree planting is in progress to convert these grass areas into forests. A part of the journey was made on foot along the lake side through an interesting temperate deciduous hardwood forest. Plantations of Cryptomeria and Chamæcyparis are doing splendidly.

The return to Tokyo was made on the evening of the twenty-ninth. During the excursions the opportunities afforded for discussion, for contact with other delegates proved to be as profitable as the sessions of the Congress. Particularly was this true of the contact with the Japanese scientists on matters of zoölogy, botany, agriculture, forestry, geology, geography, and allied subjects. The excursions before, as we found of those following the Congress, served admirably a two-fold purpose of discussion and first-hand acquaintance with Japan, her people, her civilization, and her work.

The opening session took place on October 30 at 2:20 P.M. in the Great Hall of the Imperial University. H.I.H. Prince Kotohito of Kan In, patron of the Congress, formally declared the Congress opened with an address, in which he affirmed that the co-operative work and spirit of scientific investigators constitute a solid foundation for the world's peace, a fact which shows the momentous importance of the responsibilities incumbent on the Congress. Addresses of Welcome by the Prime Minister Reijiro Wakatsuki, Honorary President of the Congress, and by Professor J. Sakurai, President of the National Research Council and of the Third Pan-Pacific Science Congress, followed. Responses to the addresses of welcome were made by leaders

of the delegations from the represented nations. Dr. Victor Vaughan responded for the delegates of the United States, Colonel Sir Lenox Conyngham for those of the British Empire, Mr. La Croix for those of France, Dr. F. A. F. C. Went for those of Holland, and so on for the nations and their dependencies within the Pacific.

On the evening of October 30 the delegates were invited to a formal dinner by the Honorary President, the Prime Minister. This was the first of a number of social affairs including lunches, dinners, and garden parties to which delegates were invited. Among the garden parties should be mentioned that given by the Prince Kotohito of Kan In, by Baron Shidehara, and the Imperial Chrysanthemum Garden party. In all these occasions opportunities for contact with the Japanese delegates as well as overseas delegates were made. The toasts and replies at dinners and luncheons were characterized by repeated assertions that science knows neither national, nor racial, nor creedal boundaries; that scientists engaged in co-operative scientific endeavor for the welfare of all the people of the Pacific region would establish important bonds of friendship among the nations of the Pacific. Statesmanlike utterances were made.

Composition of the Congress

The delegation of the Congress numbered a total of 565 distributed among the various scientific units of the Pacific as follows:

OVER-SEAS MEMBERS OF THE CONGRESS

Australia	22
Canada	5
Chile	1
China	19
France	6
Great Britain	3
Hawaii	8
Hongkong	1
Netherlands	3
Netherlands, East Indies	9
New Zealand	5
Papua	1
Peru	1
Philippines	10
Portugal	1

Straits Settlements	3
Sweden	1
United States of America	44
U.S.S. Republics (Russia)	8
Total	151

There were forty-two ladies accompanying members.

OVER-SEAS MEMBERS CLASSIFIED ACCORDING TO THEIR SPECIALTIES

Agriculture and Forestry	6
Botany	20
Chemistry	2
Entomology	1
Ethnology and Anthropology	10
Geodesy and Geophysics	13
Geography	5
Geology	30
Hygiene and Medical Science	9
Oceanography	5
Seismology and Volcanology	7
Veterinary Science	1
Zoölogy	13
Miscellaneous	29
Total	151

JAPANESE MEMBERS OF THE CONGRESS

Architecture	5
Agriculture and Forestry	39
Astronomy and Geophysics	19
Botany	32
Chemistry	25
Engineering	26
Entomology	8
Ethnography and Anthropology	7
Fishery	7
Genetics	5
Geography	6

Geology	54
Mathematics	7
Medicine and Hygiene	63
Meteorology	8
Mineralogy	5
Oceanography	5
Physics	23
Seismology	6
Veterinary Science	12
Zoölogy	23
Miscellaneous	30
	414
Over-Seas Members	151
Total Members	565

Organization

To attain the desired end of "solidarity of feeling and action" the executive council prepared the following general plan of organization. Different branches of science were grouped together to form two broad divisions; namely, physical and biological sciences. Each division was again divided into sectional meetings to provide symposia for individual branches of science. Frequent divisional meetings served the rôle of joint sectional meetings. Thus a wide range of interests was reached by the discussions. And again joint divisional meetings were held at the beginning and end of the Congress and in the course of the Congress whereby the solidarity of the Congress was realized. Mindful of the difficulty of handling a Congress with such wide interests as all the sciences, this plan of organization worked admirably.

Such a Congress might have been another Tower of Babel. It was on the contrary not a confusion of tongues. Properly the language should have been Japanese, but the Executive Council in its wisdom and fine spirit decided to make English the official language of the Congress, which, as Colonel Lenox Conyngham aptly said in his reply to the addresses of welcome, was on the part of the Japanese "a concession to our weakness." We were very grateful for this concession. It was a generous gesture on the part of the Japanese delegates who handicapped their presentation and discussion of papers out

of courtesy to groups of over-seas delegates whose native tongues were founded on the English language.

Fully 400 papers were delivered in the sessions of the Congress. This large number required the restriction of the time of presentation to 5, 7, 10, 15, and at most 20 minutes. Chairmen had the unpleasant task of holding members to their allotted time. The net result was that the majority of the papers were presented in the form of their abstracts. Some comprehension of the abbreviation that was necessary may be judged from the necessity of Dr. Bailey Willis having to present one of his papers on the "Geotectonics of the Pacific" in seven minutes. More time for discussion was possible in the sectional meetings but it in every case had to be curtailed. It becomes a stupendous task to consider 400 scientific papers on all phases of scientific interest.

It is on this point that future congresses may find it advisable to restrict the number of subjects considered, by clearing away much of general material previous to the sessions of the congress to leave outstanding problems only to be examined.

My paper entitled "Factors Influencing the Surface Run-off of Rainfall" was delivered and illustrated with slides in the section of agriculture on Wednesday, November 3. As an outcome of this paper a resolution was passed by the section of agriculture and later by the Congress recommending the restriction of cultivation to lands with gradients safe from erosion; systematic studies to determine the safe gradients for cultivation of sloping land; the terracing of lands to maintain safe gradients; and the maintenance of all other lands in a cover of vegetation.

Accomplishments

Space will not permit an account even of the more important papers. Oceanography, which was entended in scope as will be noted in the resolutions, geophysics in its relation to earthquakes, human geography and ethnology, fisheries, botanical studies, and agricultural subjects occupied the chief places of interest in the Congress. Several general lectures by noted scientists were delivered. The Proceedings will contain and make available all the papers, many of which we were anxious to hear but could not because of conflicts.

Science in Japan

The large number of papers of original research which were presented by the Japanese members of the Congress was an index of

the status of scientific achievement in Japan. I dare say that every over-seas delegate was surprised at the extent of the advance in knowledge which the Japanese scientists have made. Mature Japanese scientists have been sent to all parts of the world by a foresighted government to learn and take back to Japan the best that "western" science has produced. These men have adapted what could be used and have improved on some discoveries. They have in some cases advanced knowledge by their own original work, particularly in its application to human needs, beyond that of the west. Notable here are the researches in fisheries and improvements in the industry and science of sericulture. Likewise the intensiveness of agriculture has produced perhaps the most perfect conservative utilization of the plant, soil, and water resources of the land area thus far attained. Much is yet to be done, as is recognized by the foremost scientists, but "western" science has nowhere of which I have knowledge equaled this balanced usage. Scientific seismology began in Japan and has developed to a foremost rank among the sciences. Forestry, an applied science, has equaled and in some respects surpassed the practice in other nations. In fact it became evident throughout our excursions, the sessions of the Congress, and in our visits to the experiment stations and universities that the wise and conservative utilization of natural resources of the earth with a view to supplying and maintaining the needs of a resident population has reached a stage not attained by any other country. The fact that necessity has served as an urge in no way detracts from the achievement. Notable examples may be found where people have submitted to lowering the standard of living as the populations reached the production capacity of their lands. This Japan has not done, rather has she increased her standards of living and has made use of science to increase the effectiveness of the natural resources of animal and plant life, soil and minerals, water and climate. The conquest is not yet complete, but it is far advanced.

Permanent Organization Established

As a result of the work of the Committee on Permanent Organization a constitution and by-laws were presented to the last session for approval. With slight modifications, the constitution was adopted; it created a permanent association to be known as the Pacific Science Association. An interim bureau will carry on the business between congresses.

The Location of Fourth Pacific Science Congress

An invitation by the Dependencies of the Netherlands Government was extended to the Congress to hold the fourth session of 1929 in Java. This invitation was unanimously accepted.

Significance of the Congress

The significance of the Congress cannot now be appraised. Its influence will be far-reaching. It has become clear that there is neither occidental nor oriental science; science is universal. It is impartial, disregarding all political or other delineations.

The Congress was virtually Japan's début into the world of science. Japanese art has long been recognized; for the Japanese are preëminently artistic. In recent years Japan's military power has increased to such an extent as to cause anxiety. These are manifestations which the occident has been able to see visually. The language barrier has kept hidden much of the scientific achievement until the present Congress.

The present status of science in Japan is all the more remarkable because of the short period of scarcely fifty years in which this position has been achieved. The year 1879 was a year of beginnings. In that year the Tokyo Imperial University was founded; likewise the Imperial Academy. The first efficient apparatus for recording earthquake vibrations was made in 1880 by James Alfred Ewing, a foreign professor in the Tokyo University. In 1879 the meteorological observatory was founded in Tokyo. Dr. J. Sakurai, the president of the Pan-Pacific Congress, studied in England from 1876 to 1881 and began in 1882 with Professor Divers the organization of a department of chemistry in the College of Science. Thus in one man's life time has science in Japan germinated, taken root, and grown into a vigorous and great tree whose fruits are now being utilized for the benefit of the people. The quick take of the graft of science on the civilization of Japan bespeaks a high state of culture to which the Japanese people had attained before the intercourse with western peoples.

International Friendship is Based on Understanding

That science knows neither national nor racial nor credal boundaries was a theme which recurred in the toasts and replies at dinners and luncheons in the speeches of representative over-seas delegates and officers of the National Research Council. This theme was likewise taken up in the editorials of the Japanese papers during the Congress. We were informed that the spontaneous and cheerful greet-

ings of the thousands of school children who met us along our travels were given us by the children believing that we were messengers of peace and good will to Japan. The scientists met at the Congress uninstructed and were prepared to examine all facts which might contribute to the solution of the problems in hand. On this basis confidence and understanding are built up. Likewise it became apparent that co-operation is necessary in improving the food supplies of the Pacific. Particularly is this true of the great food resources of fish life in the Pacific waters.

It is significant that the co-operation of scientists in the study of the problems of the Pacific is perhaps the most effective method of laying the foundation for mutual understanding among peoples of the sixteen national groups bordering the great Pacific ocean. At the same time a grave responsibility falls upon international scientists.

ONE WAY OUT

By L. F. Kneipp

Assistant Forester

The time is approaching when an established, well managed, highly productive forest will furnish its own social and economic justification. With a sustained yield based upon a nice balance of age classes, and with the hazards of fire, bugs and disease held to a minimum by the concerted action of private and public agencies, the investment possibilities of such a forest will guarantee considerate and constructive ownership, for which it will return a reward commensurate with the demands upon capital and managerial skill.

The only joker in this premise is that the present number of such forests is so small as to be almost negligible. The evident future demand will have to be supplied partly by the slow conversion of existing stands, partly by forests built from the ground up by expensive and time consuming processes, where for many years taxes and carrying charges will run like a hare, while revenues will crawl like a tortoise. As in the ancient fable, the order, in time, will be reversed but only after the race is well run.

During that unproductive interval, successful forestry will demand two things: (1) widely diversified technical organizations and (2) cheap money. It will be very difficult for the private owner to command either one, and by no means easy for the lesser political units to do so. Only the Federal Government can organize and maintain a technical staff adequately covering all fields of forestry, and only the Federal Government can borrow money at 4 per cent or less. Why then, is it not logical to look to the Federal Government to underwrite the constructive period in the development of a forest during which the burdens are discouraging to private initiative?

This thought suggests many possibilities, most of them impracticable. The Government could loan money at a low interest rate; it could agree to make good losses; it could pay a bonus to the successful timber grower; it could guarantee the bonds, debentures or notes through which forest ventures were financed. It could—but only at the risk of serious abuses and heavy losses, or through the creation of a tremendous organization through which to conduct the supervision,

accounting, and collections required to protect its interests. Conflicts between debtor and creditor would occur with their historic inevitability.

But established business practice affords a precedent worthy of consideration. It is a common enough occurrence for men of peculiar qualifications and abilities, and good credit, to acquire control of broken down business properties, finance them on a sound basis through the floating of attractive securities, organize them into productive, profitable institutions, and then having done all that turn them over, usually at a profit, to other persons for permanent operation as successful commercial enterprises. During the constructive period when the man's financial credit and business standing are at stake he assumes all risks, but—he retains complete control. When the enterprise reaches a stage where it successfully can be taken over by others its restorer cedes all control to those others. He has done his part; he has taken his profit; the successful consummation of his work by others is guaranteed without his further participation. Why would not a similar principle be applicable in this intricate business of transforming forestry from a process of exploitation to one of constructive production?

So far, so good. Now comes the question of financing so large an enterprise. And when the subject of bonds is mentioned some of our most distinguished foresters will recoil in horror. Their slogan is "Pay as you go. Finance your forests from current revenues." As an ideal that is fine and generous; its only weakness is the evident disinclination of the present generation to pay enough as it goes; to finance from current revenues a sufficient acreage of forest to meet the needs of the generations that are to succeed it. Those later generations may suffer severely through our unselfish idealism. One does not know, of course, but one is justified in assuming that the citizen of the year 2027 would rather have a thousand dollar debt and a thousand dollars worth of timber with which to meet it than to have neither debt nor timber. However, not all foresters are bond-shy; one contingent clamorously has advocated bonds as a means of financing forests for some years past.

Then comes another debatable point, to wit, the wisdom of the Federal Government working strenuously for two or three decades to build a forest and then turning it over to others to mismanage or destroy. Many loud expostulations may be expected. But nobody would get one of Uncle Sam's forests until they had reimbursed all the good money it had cost him and no one who has done that is going to start

wrecking operations soon thereafter. Besides, by the time the first renovated forest is ready for sale, forest wrecking shall have been classed with other practices of the dark ages.

Just as a flight of highly imaginative fancy, the possibilities of the idea have been reduced to the form of a legislative measure. Here it is. What do you think of it?

A BILL

To Encourage and promote the protection and development of the forest resources of the United States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury be and he hereby is authorized and directed, upon recommendation of the Secretary of Agriculture, approved and ratified by the National Forest Reservation Commission created by the Act approved March 1, 1911 (36 Stat. 961), to issue to the owners of lands conveyed to the United States under the provisions of this Act in the manner and according to the provisions hereinafter set forth, bonds of the United States which shall be payable fifty years from date of issuance unless sooner called for payment by said Secretary, which shall bear interest at the rate of four percentum per annum, payable semi-annually, which shall be so registered as to show current ownership and the lands for which they were issued in payment and which shall be subject to taxation either as to principle or income only within the State within which is situated the lands for which said bonds were issued in payment, but the par value of such bonds issued and outstanding at any one time shall not exceed a total of two hundred million dollars.

SEC. 2. That whenever the owners in fee simple of ninety percentum of the lands comprising an area chiefly valuable for the production of timber or other forest products and containing not less than fifty thousand acres of land shall in due form submit to the duly authorized and designated officials of a State a petition to have said lands established as a Forest Development Area and an agreement to accept in full payment for the duly appraised value of such lands bonds of the character authorized by Section one of this Act; which petition and agreement are approved and ratified by said State officials in the manner and form prescribed by the Legislature of said State in conformity with its constitutioinal provisions; then and in that event said area may by Presidential Proclamation or Executive Order be declared a National Forest Development Area to be administered by the United States Department of Agriculture under the provisions of this Act.

SEC. 3. That upon the establishment of a National Forest Development Area all of the provisions of sections six to twelve inclusive of the Act approved March 1, 1911 (36 Stat., 961) as amended, shall become applicable thereto, *provided,* that all payments for lands acquired under the provisions of this Act shall be in bonds of the kind authorized by Section one of this Act and in no case shall exceed the amounts approved by the National Forest Reservation Commission.

SEC. 4. That if a State within which a National Forest Development Area is situated, through formal action by or under authority of its legislative body, shall file with the Secretary of Agriculture (a) a formal announcement of its intention to assume ownership and control of the lands within a National Forest Development Area which have been acquired by the United States under the provisions of this Act and (b) an agreement to permanently retain and manage said lands as a State Forest and shall pay into the Treasury of the United States a sum representing the total cost to the United States of the acquisition, administration, improvement and protection of said lands, then and in that event the Secretary of Agriculture shall by proper deed of transfer convey said lands to said State subject to the terms of the agreement aforesaid.

SEC. 5. That where such action will be in the public interest, the Secretary of Agriculture may cause an appraisal to be made of all lands owned by the United States within any National Forest Development Area, which appraisal shall be based upon the fair commercial value of said lands as determined by the prices and conditions prevailing in local commercial practice, but in no event shall said appraisal be less than the total amount expended by the United States for the acquisition, management, administration, improvement and protection of said lands. Upon approval of said appraisal by the National Forest Reservation Commission, *supra,* and with the specific authority of that body, the Secretary of Agriculture after serving due notice of his intention upon the proper officials of the State in which said lands are situated, and after publication of his intention in not less than three newspapers of general circulation within said State for periods of not less than ninety days, may proceed to offer said lands as an entity at a general public sale to the highest and best bidder at a price not less than the appraised value approved by the National Forest Reservation Commission, subject to a stipulation in the deed of conveyance that said lands will be retained and managed primarily as forest productive properties for a period of not less than twenty years from date of sale, and shall revert to the United States upon proof before a Federal court of jurisdiction that they are not being so managed. In such sales the holders of bonds issued under authority of this Act shall have a preferred or prior right to acquire said lands at the highest and best price bid; and said bonds, if duly registered and valid, shall be accepted at their par value in payment for said lands.

SEC. 6. All receipts from the use and occupancy of, or the sale of products from lands acquired under the provisions of this act shall be deposited in the Treasury of the United States in a special fund to be known as the National Forest Development Fund and no disbursements from said fund shall be made by the Secretary of the Treasury except (a) in payment of interest due upon outstanding bonds issued under authority of Section one hereof, or (b) to retire such bonds upon maturity or when called for redemption by the Secretary of the Treasury upon recommendation of the Secretary of Agriculture; but if the amounts available and unobligated in said National Forest Development Fund are insufficient to meet current requirements for the payments of interest due upon bonds duly issued and outstanding, or to retire bonds which have matured as to principle, the appropriation of such amounts as may be necessary to make up such deficiency as may exist from funds in the Treasury of the United States otherwise unappropriated is hereby authorized.

POLITICS AND SCIENCE AS AFFECTING PUBLIC LAND MANAGEMENT *

By Mark Anderson
President Utah Conservation Association

We hear much of science and religion. We hear less of science and politics. It is my belief, however, that the problem of harmonizing science and politics is of much more immediate concern in our country today than is the dispute between the fundamentalist and the evolutionist.

I believe that at the bottom of nine-tenths of the trouble of your department today, lies the one general difficulty—that of making science and politics mix. Why this great chasm between these two forces? Authority tells us that the cause of this opposition is not due to any clash between democracy and science, but is a result of our peculiar brand of perverted politics. This being the case, we must develop a new school of thought in politics. Reform in this direction can only be expected when we have developed a more intelligent and aggressive citizenship.

The Forest Service is continually faced with the problem of bridging the gap between science and politics in the management of our national forests.

In public land management, we should work from facts to policy. The politician works from policy to facts, selecting, of course, only those facts that substantiate his pre-conceived theory or conclusion. Here we have the essential difference between the average lawyer and the scientist. The lawyer sets up a certain theory and then sets out upon the task of proving it. The scientist develops his theory only after the facts have been gathered. It is naturally hard for these two gentlemen to understand each other. The scientist rests his case upon experimentation, while the politician rests his case upon exhortation.

After much thought, or attempt at thought, I have arrived at the conclusion that your greatest task is to bridge this great gap between the scientist and the politician.

We recognize the menace to your policies and to your very existence as an organization in the old but yet new policies of states' rights.

* Presented at meeting of Intermountain Section, Society of American Foresters, Ogden, Utah, Feb. 4, 1927.

Politicians all over the country are just now capitalizing upon this line of political prejudice and theory. No doubt, there is some merit to the states' rights argument. Fine catch words and phrases, and stirring orations can easily be made upon this subject. In our next presidential campaign, we will probably see this states' rights idea loom large upon our political horizon. It appears to me that the states' rights theory as now defended by some of our leading men, will not stand the test of thorough study and thought. Some of these ardent states' rights men talk of the Federal Government as if it were something foreign and not a part of us. But, is it not a fact that state lines and all artificial barriers mean less today than at any time in our history? Are we working toward a creation or a destruction of political, religious and trade barriers? A citizen of the United States, and let me emphasize United States, cares little about state lines as he speeds over our Federal highways in his Ford or his Packard. Force this states' rights idea to its logical conclusion here in the West, and we will have no further Federal aid in the building of reclamation projects, in the building of our roads or in the tremendous conservation work yet to be accomplished. We are just now asking the Federal Government to appropriate $350,000 to reclaim the Bear River Bay country as a means of saving our migratory water fowl. Let the states' rights advocate show us how we may have these things without Federal aid. Also the states' rights advocate must show us where the local government is more efficient in these things than the general government. We are closer to Washington today than we were to our state capitol twenty-five years ago.

What might we do to bridge this chasm between politics and science in the management of our public lands in Utah? I believe that the adoption of some sort of a non-political commission idea will do more to bridge this gap than any other move that we might make at this time. It is for this reason that I advocate a commission on which all of the major groups might be represented. Those groups deserving of first consideration are our wild life conservationists, our stockmen, our farmers, our recreationists, our municipalities interested in watershed protection, and our lumbermen.

It is appreciated that the politician will never support such an idea, because anything that might tend to harmonize contending interests will also lessen the power of the politician who benefits by the lack of harmony that exists or may exist between the different groups.

Many non-salaried and non-political fish and game commissions are functioning successfully in various states today, and a few states have adopted the broader conception and included all phases of public land management under a conservation commission. Michigan, Minnesota and Illinois have adopted this latter plan, which is copied to a great extent from Pennsylvania. California, Wyoming, New Mexico and Montana have applied the idea to fish and game alone with great success.

In this problem of game versus domestic stock, we can see a chance for the development of much prejudice, and the use of this prejudice by the politician. However, I feel that it is to the interests of all groups to eliminate political prejudice as much as possible in this matter. Let's have facts and a balanced program that will give proper consideration to all groups interested in the use of our public lands. Again I am sure that a commission such as we suggest could do much to harmonize these various interests and bridge the gap between politics and scientific management. A continuous political fight can only result in injustice to one or all interested groups.

We have just now arrived where we realize that there is something more than protection to proper wild life management. We must provide for wise utilization and a proper distribution of our game, as well as provide for protection.

My idea of the position of domestic livestock grazing is just this: Forage, as well as all other public land resources must be put upon a sustained yield basis, granting something to all interests involved. Grazing use, we know, can be harmonized with the best theories of public land management. However, the public generally does not think so. The stockman must save himself and his industry by co-operating with, rather than opposing the expert. If he fails to submit to regulation, it appears that he will suffer one of two fates. He will either be crushed by public opinion, or exhaust the resource upon which he depends. We fancy that we see a way out for the stockman. Will he place his case in the hands of the politician or in the hands of the expert?

In times past a trained forester has looked upon range management as something not a part of his work. I am sure that this attitude has changed, as rightfully it should. Range problems are definitely a big part of the forester's burden in this region. We will find as time passes if we are not already aware of this, that range management is much more intricate and involves more factors requiring close study than silviculture or strict forest management. The forester and the

stockman must both appreciate this. Again, this is largely a scientific and not a political problem. If we are to expect a sound and lasting solution, we must welcome the scientific expert.

Even if our commission idea fails, the Forest Service can continue to serve as a great balancing agency in equalizing the differences between the users of our national forest resources.

All that the wild life interests ask is that this existing resource and vastly more potential resource be given a place in the sun, but not to the exclusion of all other interests. We believe in your capacity to deal justly with all groups. We believe that only those who use our public land resources properly are entitled to the enjoyment of this privilege. We welcome the expert, and are anxious to see the power of politics and the knowledge of science brought together to promote conservation generally. Let's work from facts to policy, rather than from policy to facts.

Finally your organization and your work will not be judged by whether or not you have been good politicians, but by whether or not you have properly protected and effected a wise utilization of the public resources in your charge.

REVIEWS

Stor Norrland. By Ludvig Nordström: Albert Bonnier's Förlag, Stockholm, 1927. 310 pp. (See especially pages 241-254.)

A Bolshevist Vindicated

In European forestry a certain system or type of management is almost always linked with an individual's name, the forester who by many years of conscious effort along a fixed line has left his mark in the woods and not merely on paper. This is why visits to European forests are so interesting; one visits a man first and foremost, and the forest reflects his individuality. In America, with a few notable exceptions, not enough years under one man's uninterrupted management have yet elapsed to allow the development of such forests. In many places the forest has left its imprint on the man and not the man on the forest.

We look for forest economic conditions in Europe comparable with those in America, and, after a varying search through France, Germany, Switzerland, and yes, even Finland, find the nearest approach to them in northern Sweden, the great Northland, which Ludvig Nordström extols in his recent book.

In 1912 a tall, athletic, young graduate of the forest school in Stockholm returned to the employ of Kramfors A/B, one of the oldest and largest pulp and lumber companies in northern Sweden. Unhampered by the rigid forestry dogmas of his day, he brought to his work a knowledge of the fundamental principles of tree and plant growth, as then known, and set about applying them to the growing of pulpwood and lumber. His name was Jägmästare Erik W. Ronge.

In the province of Västernorrland middle-aged stands of pine (*Pinus sylvestris, var. lapponica*) and spruce (*Picea excelsa*) which had come up after burns or clearcutting were dense; the ground was thick with moss and blueberries, under which raw humus matted itself in age-long layers. In this latitude (nearly the same as central Alaska) spring comes late and frost lingers still later under the raw humus blanket. Ronge noted this and made heavy thinnings on a few sample plots, removing many, if not all of the smaller trees which might shade the ground. Seventy-five per cent of the tree number and 50 per cent of the volume might quite commonly be removed in the first thinning. In

many cases this meant a direct expenditure for silviculture with no immediate return; small saplings not yet large enough for sulphate or sulphite pulpwood, as well as nearly all birch (*Betula verrucosa*) and poplar (*Populus tremula*) must be cut and left on the ground; for in this region charcoal-making in the forest is not profitable, and only a small local market exists for firewood. So Ronge hesitated to apply such thinnings on a large scale. The dense young stands thus cut through appeared to many foresters like a slaughter of the innocents. Where 12,000 to 15,000 stems per hectare had stood, but 2,000 were left—no trees spaced closer than 2.3 meters was his rule, even for trees no larger than one's wrist—it was radical. To the forestry mentors, schooled in conditions far to the south, such cuttings meant the ruin of soil productivity, the favoring of wolf-tree types, the wanton sacrifice of forest capital. Such heavy cuttings were bolshevik; Ronge was a bolshevist among foresters. He was called that, and many things even less complimentary, most often behind his back, by foresters and lumbermen in the neighborhood. Ronge kept about his work and called the trees to answer the charges of his opponents.

The years passed and results of the earlier thinnings began to be apparent to the eye as well as in sample plot figures. Where more than half the volume had been cut the production in solid wood per hectare per year had increased nevertheless; sometimes two-fold, three-fold, or even more, over the unthinned stands. Calculations of value and price increment were no less astounding. It was wonderful how these small pine and spruce, once freed from crowding and the ice which encased their roots half the summer, could react. Here are a few figures.

Scotch pine flat

	Before thinning			*14 years after thinning: age 85 yrs.*		
	No. of stems	C.A.I.		No. of stems	C.A.I.	
Per har.	770	2.0 cu. m.	1.22%	472	5.8 cu. m.	4.17%
per acre	308	28.2 cu. ft.	1.22%	189	81.9 cu. ft.	4.17%

Scotch pine, steep slope

	Before thinning				*9 years after thinning: age 65 yrs.*			
	No. of stems	vol.	C.A.I.		No. of stems	vol.	C.A.I.	
per har.	2057	250 cu. m.	4.1 cu. m.	1.6%	900	125 cu. m.	9.5 cu. m.	7.6%
per acre	1003	3530 cu. ft.	57.9 cu. ft.	1.6%	360	1765 cu. ft.	134.1 cu. ft.	7.6%

But Ronge was not content with merely securing increased production after heavy thinnings; he must have scientific basis for his practice, and be sure of results before applying it everywhere. So he placed soil thermometers at different depths in both thinned and unthinned stands of spruce—"Stavagran" it was called because the trees were only as large as ski staves although 120 years old. He went about daily in the spring and summer with a steel rod, which he thrust into the ground and noted the depth at which he struck frost. In the unthinned stand he frequently found frost as late as August 1, while in the heavily-thinned part where the sun could reach the ground, frost disappeared entirely early in June. Soil temperatures showed proportionate differences. He pulled up some of the trees by the roots and found a large part of the deeper roots dead, but new roots being sent out along the surface, trying to keep in the warmest layers of the moss and raw humus. He also found that a few years after the heavy thinning the same trees had obtained a firm grip in the sand and gravel and that the raw humus had become less dense and matted. Still further—for he was thorough—he made observations and measurements of the time and extent to which both height and diameter growth took place in the case of pine and spruce. He found that height growth took place during only about thirty-eight to forty days, beginning the first week in June, and that diameter growth occupied about fifty-eight to sixty days, beginning only slightly later. No appreciable growth took place until the soil temperature at the active roots of the tree exceeded five degrees C., no matter on what date this occurred. There was abundant proof from experiments elsewhere that the time of the year when growth took place could not be altered, at least for many generations, for one race of a species. It was during the long June days, which in Norrland provide twenty to twenty-two hours of sunlight daily, that buds and cambium were stimulated to activity. Be it photoperiod or other cause that called them to life, this tendency among trees in this region could not be changed. All the forester could do was to provide suitable growing conditions for the tree during this period by allowing the sun to warm the soil, and by giving the tree growing space to assimilate as much as possible during the short summer. The heavy thinnings were also beneficial in that they let the snow—which in dense stands collected on the trees and evaporated—reach the ground and cover it deeply, thus protecting the soil from deep freezing. Soundings showed that frost did not penetrate so deeply on the thinned plots, while the

snow cover was two to three times as deep as under the unthinned stand. In the spring the snow melted quickly on the thinned plots, letting the sun strike the soil; under the shade of the unthinned forest, both frost and snow remained late.

Once convinced he was on the right track, Ronge soon persuaded his company, whose president, Baron J. Mannerheim, is one of the most progressive and respected men connected with wood-using industries in the Baltic lands, to apply such cuttings on a large scale. Crews of men, armed with sharp light axes, ranged through the woods from early spring until late fall, clearing out young stands to a spacing of approximately 2.3 meters (7½ feet) for trees less than 6 meters (20 feet) in height, and about 3 meters (10 feet) or more for taller trees; large overtopping birch were girdled. Ten to twelve men composed a crew and the foreman also carried (and used) his axe. Fifty ore (fourteen cents) per hour was the pay, and the cost came to about fourteen kr. per hectare ($1.50 per acre). Since most of the trees cut were unsalable, this represented a direct silvicultural outlay. At present Kramfors Company covers thousands of hectares annually in such cuttings.

As the beneficial results of these thinnings became apparent, some of the neighboring owners, among them some of Ronge's former antagonists, began to follow his example. A district supervisor of the national forests in the vicinity, who had been one of the bitterest opponents of heavy thinnings, now began to have them carried out in stands adjoining those of Kramfors Company so that the dissimilarity in the growth would not be so apparent. He first thinned along the roads where people could see, and later carried the thinnings farther back. One by one other companies began to fall into line and follow Ronge's example.

Visitors came to look and to make increment borings (the writer among them). Some trees soon came to look as if they had been attacked by woodpeckers. The writer first visited these forests in 1923, and now after a lapse of even four years, changes are apparent. Long leaders are shooting up from the tops of trees long stagnant; there is a deeper green in the foliage indicative of chlorophyl at work. Trees which four years ago could be swayed on their roots are now firmly moored in the sand. Borings show that enormous increase in diameter growth takes place about three to four years after thinning, and that after about ten years this increase begins to slacken. Return thinnings are therefore indicated at about twelve to fifteen year inter-

vals. These later thinnings will remove merchantable products, and it is not contemplated that expensive cleanings will ever again be required under proper management, once the stands have been put in production. Probably a kind of selection or group selection will be practiced.

It would be no exaggeration to say that Jägmästare Ronge is known far beyond the bounds of Sweden because of these cuttings, but he is equally well-known as the originator of the "two-price system" for paying contract woods labor, and for his excellent system of forest bookkeeping. Suffice it to say that the growth per hectare on the lands of the Kramfors Company is on the increase and in the future a larger and larger per cent of the needs of the mills in pulpwood and sawlogs will be provided from its own lands. In July, 1927, when a special conference was to be held in Finland, following the Second Northern Forestry Congress, the Finnish delegation made a special request that Jägmästare Ronge be one of the ten Swedish representatives. This from Finland where the dread of Bolshevism is almost fanatic!

In conclusion perhaps it would not be amiss to point out that probably exactly opposite measures than opening the ground to sunlight are called for in the greater part of central Europe and the United States. However, northern Canada and especially Alaska may present conditions where it is possible Ronge's tactics might be applied successfully. Quite aside from the silvicultural complexities, which are always a fit subject for controversy, this little sketch aims to bring out two great facts; the importance of intelligent openmindedness in dealing with living complexes like forests; and the necessity of patient, long-continued management under a steady policy for results in the forest.

Henry I. Baldwin

Factors Controlling Germination and Early Survival in Oaks. By Clarence F. Korstian. Yale University, School of Forestry, Bulletin No. 19, New Haven, Connecticut. 1927. Pp. 115, Plates 7.

In this nicely printed booklet originally submitted as a dissertation for the degree of Doctor of Philosophy, Korstian has presented the results of a search for the causes of variations in germination and early seedling development of the oaks. He has gone further into the subject than other American investigators and contributes original data, interesting methods, and lines of attack, and a good analysis of the factors involved and their importance. At the same time, owing to the brief period of two years, during which the work was carried on and

in common with most research into biological processes, the results are still preliminary and indicative rather than final and conclusive.

An excellent summary of two pages and another two pages devoted to the application of the results in silvicultural practice contain a clear presentation of the conclusions which were reached and their import in the silvicultural management of the oak forest. Most foresters will find in these last four pages a very large part of the information in the bulletin which will be useful to them. The conclusions are worth summarizing briefly.

1. Ninety to 100 per cent of the acorn crop may be consumed or destroyed by animals, especially rodents.

2. Insect injury, mostly by nut weevils, varies from no injury on the acorns of certain chestnut oaks to over 50 per cent on some black oaks.

3. White oak acorns normally containing 60 to 70 per cent of moisture show a marked decrease in viability when the moisture content falls below 25 to 30 per cent. Red oak acorns normally containing 50 to 60 per cent of moisture show a marked decrease in viability when the moisture content falls to 20 or 30 per cent. Loss of viability occurs when the moisture content falls to 10 or 15 per cent.

4. Moisture conditions favorable to the germination of acorns are usually provided by a protective covering of soil or leaf litter.

5. Temperatures suitable for germination varied from something over 40° F. to 80° F. at night and 95° F. during the day. Average night temperature of 50° and day temperature of 65° were most satisfactory in providing the best combination of promptness and total amount of germination.

6. Delayed germination in the black oak group was demonstrated and the cause was probably inherent in the embryo itself. "The embryos of this group have a much higher fat content than those of the white oak group, and the need for a rest period and higher temperature to hasten after-ripening is probably associated with enzymic action and the conversion of the fats into soluble carbohydrates during after-ripening and the early stages of germination."

7. Acorns cannot withstand the heat usually generated in fires in the leaf litter. The relative susceptibility beginning with the most resistant is: red, chestnut, black, scarlet, and white oak.

8. The larger, heavier acorns gave the highest germination percentage and also the largest, most vigorous seedlings at the end of the first year.

9. Temperatures between 33° and 38° F., combined with high atmospheric or soil moisture, are the most important factors in maintaining the viability of acorns in either artificial or natural storage.

10. The radicles of germinating acorns are unable to penetrate soil which is excessively compact at the surface. The limit of penetration measured with a penetrometer was found to fall between 0.01 and 0.023 mm. per gram of load applied.

11. The leaf litter of the forest floor is of the greatest importance in producing conditions suitable for the germination of acorns and the survival of seedlings. This is due to the influence of the leaf litter in reducing water loss, equalizing temperatures and facilitating root penetration.

12. Optimum seed bed conditions and the natural regeneration of oak by seed is most readily obtained by a form of partial cutting, either by the selection method or by the shelterwood method in which the stand is removed in two or three cuts. One or more of these cuttings often become unnecessary when advantage is taken of the presence of advanced reproduction on the area at the time of cutting.

The greater part of the bulletin is devoted to a detailed analysis of the factors, review of the literature of the subject and presentation of the methods and data in detail. This portion will be interesting chiefly to those who are concerned with the special study or investigation of similar problems in oaks or other tree species. The review of the literature appears to be thorough and is amply supported by a bibliography of 142 references.

The results are contained in a considerable series of tables and graphs to which the reader is usually referred for conclusions on the particular factor under discussion. In the graphs and smaller tables this is satisfactory, but unfortunately many of the tables are large and contain many items in several columns and are arranged in the numerical order of plot or lot number. Consequently, the figures for germination or survival for four or five different species under four or five different conditions or treatments, have no sequence or classification which permits the reader to draw conclusions. In fact it is difficult to see how the author himself could have arrived at conclusions from these tables without reclassifying and rearranging the data. Either a rearrangement or reclassification of the data in tabular form, or a more complete discussion of what it shows in the different sections of the text would have been helpful.

Several interesting points are brought out, which, owing to their

incidental nature, were not included in the summary. The acorn crop per tree in trees from ten to twenty-seven inches varied from 1,754 nuts of chestnut oak, to 20,388 in a red oak. The investigation did not apparently include and does not discuss the possible influence of the character of the individual parent tree on the germination of the acorns or survival of the seedlings.

The flotation test was found to be worth while only for the separation of badly infested, diseased, or aborted acorns in lots where there are many of them. It is not a suitable test, however, for soundness of the acorns. Dark color in white oak acorns is a good indication of high germinability as compared with light color. Experiments in nursery beds indicated that a soil covering from one-half to two inches deep resulted in generally unsatisfactory germination and survival.

In connection with the discussion of the effect of temperatures in fires on the viability of the acorns, graphs are presented giving the temperature records by minutes in a series of actual fires in which the temperatures were measured with a potentiometer-thermocouple. Maximum temperatures were usually found two to three minutes after the fire reached the point, and they varied from about 300 up to 1,000° F. After ten minutes the temperatures had dropped down to 200° or less. Maximum surface soil temperatures up to 143° were recorded near Asheville, North Carolina, and were found to be a sufficient reason for the injury or death of seedlings up to two months old before the stems become lignified. The equalizing effect of leaf litter on maximum and minimum temperatures at the surface of the ground is brought out graphically for a three months' period in the fall.

In connection with Korstian's use of the penetrometer of the New York Testing Laboratory in determining the compactness of the surface soil, it is interesting to note the emphasis which Professor Albert places on the compactness of the soil as an important factor in forest regeneration and growth in Germany, and the instrument* for the measurement of the hardness of soil which has been devised for field use.

Aside from the value of the conclusions in the silvicultural management of the oak forests, this bulletin is significant in indicating the development of forest research in this country from the stage of obtaining technical information to the stage of research into the underlying factors which are the causes of observed forest phenomena.

J. K.

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*Bodenhartemesser nach von Meyenburg. Manufactured by K. B. Schmidt & Co., Berlin-Schoneberg, Belziger Strabe 61.

Zur Frage der Waldbetriebsregelung by Erik Lönnroth. Acta Forestalia Fennica, 32. Helsinki, Finland, 1927. Pp 61. (Reprint.)

The author adds to his title, "Regarding Forest Yield Regulation," the subtitle, "With Special Reference to the Forest Conditions of Finland." It is, however, of particular interest to American readers because of the modern slant which he gives to the problems of forest management.

At the outset he reviews the fundamentals of forest regulation and stresses the need of determining in time and in place the allowed cut. This, he says, must be according to correct silviculture, correct economics, and the actual condition of the forest itself, particularly its growth.

Summarizing the forest conditions of Finland, he finds that site classes have little application in his country—forest types based upon vegetative cover are the logical and natural divisions of the forest. (This follows the path blazed by Cajander.) He admits that the present condition of the Finnish forests is not good—heavily logged in the southern part, often overmature and inaccessible in the northern part, it seldom approximates normality.

For "normal," Lönnroth discards the old definitions for one by Biolley: "A forest which had the highest obtainable increment of valuable material with the smallest possible growing stock." Accordingly, he finds an excessive increment unused in northern Finland, while in southern Finland there is a deficit in the growing stock, with a cut in excess of the increment. He urges the adoption of sustained yield for all the Finnish forests—recognizing the fact, however, that the present growing stock is seldom the best that can and should be obtained. The practical difficulties in the way of a sustained yield management, particularly in the case of private owners, cannot be solved by any legal requirements merely stipulating the keeping of a forest cover; it requires the balancing of economic needs (wood needed by the mills, etc.) against the silvicultural needs of the forest. The "will to do" is essential for successful forest management.

The author has little use for the rigid methods of yield determination devised chiefly by German authors—neither has he any hope that the Method of Control by Repeated Measurements (Gurnaud-Biolley), so successful in Switzerland, can be applied to the far flung, extensive forest conditions of Finland. Instead, he would determine the allowed cut as the volume which can be derived from the forest without endangering the productivity of the stand. This, he admits, sounds simple but is actually very difficult of execution.

Lönnroth suggests that, in the preparation of every management plan, an *attainable ideal* be set up—that is, of the forest as it *should be*. Then the actual management, accommodated as it must be to the present conditions, economic and silvicultural, will at least be consciously striving toward this ideal. For Finnish conditions he accepts the forest type as the basis of silviculture and regulation and calls his form of management "Waldtypenbetrieb"—that is, forest-type-management.

The author, recognizing the economic difficulties in the way of executing the ideal plan of management, favors the setting up of a double plan—"Doppelzustandsregelungsplan"—one for the ideal, the other for the real; the one asks, "What *should* be done?"; the other, "What *can* be done?" The conscious departure from the ideal will, he argues, be excused only by economic exigencies.

Lönnroth closes his interesting paper with a discussion of silvicultural systems, of less value to American readers except that he urges greatest latitude of choice and no attempt at an exactly predicted allowed annual cut, but rather the yearly harvest to result from correct silvicultural practices within the frame of a thoroughly thought out management plan. In the long run, he concludes, this will approximate the yearly growth.

A. B. Recknagel

The Technology of New York State Timbers by C. C. Forsaith. pp. 374, Figures 131. Technical Publication No. 18, N.Y. State College of Forestry, Syracuse, N.Y. September, 1926.

This bulletin deserves to be accorded a prominent position in the literature on wood technology. It is rather complete, detailed and copiously illustrated with schematic line drawings. All the drawings of wood elements, tissues, sections, etc., appear to be new and original. One wonders why it was not published as a textbook instead of a college bulletin; it deserves a textbook rating.

It is regrettable that the author felt he had to preface his bulletin with a reiteration of the time-worn reference to our past profligacy in the handling of our forest wealth and the impending famine. The reviewer wonders how many teachers of forestry do not dwell in their classes upon our dark past and how many see a brighter future. It isn't good for the patient's good will to have his past mistakes and excesses constantly dragged before him.

There are six chapters as follows: "The Anatomy of the Tree and Minute Features of the Wood," "The Gross Features of Wood,"

"Physical Features of Wood," "Mechanics," "Defects," "Description of Species."

The minute elements are followed through in Chapter I in considerable detail—as, for example, to tracheids the author devotes five pages of text and a full page of diagrams, and after giving general characters of tracheids he follows with variations in length, character of the wall, the skeleton, differentiation of the tracheid, hardwood tracheids, and a discussion of tracheids from the standpoint of utilization. Since no one knows exactly how the cell wall itself is made up, the author would have done well to at least refer to the hypotheses of other investigators. Chapter I is remarkably well illustrated.

Chapter II takes up the gross features of wood such as heart wood and sap wood, spring and summer wood, grain and texture, etc., but also includes color, odor, and taste usually included with physical properties. Here again considerable detail is entered into, for example, in discussing spring and summer wood, the author goes into their morphology, theories relating to the causes of differentiation, variation in different species, influence of structure of ring upon strength, etc. Medullary rays, properly gross features, are treated in Chapter I.

Chapter III deals with the physical features of wood-weight, moisture, content, conductivity, fuel value, etc. Natural durability was omitted from this chapter, even though it, or a lack of it, is an extremely important physical characteristic, and a consideration of which is an important matter in the realization of the suggested prolongation of the life of our present forests mentioned in the preface. Considerable space has, however, been given in this chapter to the important subject of moisture content and its effect upon the behavior of the wood.

Chapter IV is on "Mechanical Properties" and is quite unusual in a publication of this kind, in that it goes into the mechanics of flexure, shear, etc., as well as the mathematics and derivation of the formulæ even though it leads the author into calculus. This chapter is the longest in the bulletin and should be of great usefulness to those interested in the mechanical properties and those students who are not satisfied with a presentation of formulæ without a discussion of their derivation, or who have not had a course in mechanics. Chapter IV is excellent, but it overbalances the others.

Chapter V takes up defects such as spiral grain, knots, shakes, decay, etc. There are also included the defects developing in drying, such as checking, casehardening and collapse, a matter that should have been

disposed of in Chapter III under "moisture content." Chapter VI contains descriptions of sixty or more domestic woods. The descriptions themselves are very brief and based on observations of laboratory specimens, a practice which gets many wood technologists into trouble. Many woods are too variable to permit general application of a few descriptive words based upon a study of limited material. However, this is an excellent and useful chapter, made so especially by the thirty or more sets of schematic drawings showing the structure of as many woods in cross, tangential and radial sections.

The bulletin closes with an appendix on, "A Brief Explanation of the Calculus." The author must be a mathematician as well as a wood technologist—not a bad combination at all. The reviewer regrets the necessity of mentioning typographical errors throughout the book—they are too numerous to be overlooked.

E. F.

An Elementary Manual of Indian Wood Technology by Harry P. Brown, Forest Research Institute, Dehra Dun. Pp. 121, Figures 33, Plates 16. Central Publication Office, Government of India, Calcutta. November, 1925.

This is an elementary treatise of wood anatomy in terms of Indian timbers and is intended to fill a need for such a book in the forestry schools of India. It is a result of the author's several years' connection with the Forest Research Institute at Dehra Dun as officer in charge of the Section of Wood Technology.

The author is rather modest in the presentation of his claims. His book has really a much wider usefulness than only in the forestry schools of India. His presentation of elementary wood anatomy is well done and particularly useful to the student and the teacher. His choice of words and phraseology, however, leads one to suspect that Indian students have a more thorough command and understanding of the English language than do American students—a deplorable condition in American universities, and a handicap to both teacher and student. Much of the material is the result of considerable original investigation into the anatomy of Indian timbers. This alone makes the book a valuable addition to the general knowledge of wood technology.

The book is divided into eight parts. The first is very brief and touches in a general way on the relation between plants and animals. In Part II the author gives a classification of plants, with woody plants quite naturally enlarged upon. Part III is devoted to "The Cell,"

beginning with an appreciation of protoplasm and carrying the student through a consideration of the details he will need to better understand the cells of woody tissues. Part IV is headed, "Cell Aggregates and Tissues," and discusses the origin and classification of tissues, primary and secondary thickening in trees, cambial activity, bark and wood, physiological significance of wood formation and the functions of wood. In Parts III and IV the author assumes a knowledge of botany and of botanical terms on the part of the student. He is quite right in handling these parts as reviews; a student should have a thorough knowledge of at least elementary botany before he is permitted to take up wood technology. Part V covers the gross structural features of good—growth rings, medullary rays, grain knots, etc. In Part VI the physical properties of wood are taken up, and in Part VII the microscopy of wood. In the reviewer's estimation this is the most valuable part of the book. A very definite and consistent treatment is given of the microscopic elements and tissues of Indian timber. In Part VIII the knowledge developed in the earlier parts is developed into a key for the identification of sixty of the more important Indian timbers. There follow then sixteen excellently reproduced and ample-sized plates of photomicrographs of as many woods, mostly in cross section. The thirty-three text illustrations are largely schematic drawings by Ganga Singh and photomicrographs by the author.

Seattle, September 5, 1927. E. F.

The Whistle Punk by Stewart H. Holbrook. *Century Magazine.* August, 1927.

Much romance is still to be found in the logging camp and there still are picturesque types of lumberjacks. Now that Paul Bunyan has been immortalized in several books, it is fitting that actual characters receive the attention of clever observers and writers. The lowliest man in the present day western logging camp, though in his own mind the most important, is the whistle punk. Mr. Holbrook humorously describes him in words that give an excellent characterization of this gentleman. He describes him as "too tough to read the *Police Gazette,*" and that the "tough kids of the Bowery are cherubims beside him." And, paraphrasing and excerpting: The whistle punk's visor cap is worn smooth where he wears it over one ear. When he spits it is like a cosmic disturbance. His toughness is equaled only by his bellicose precocity. He often calls the camp boss "Boy" and gets away with it.

He horns in on the stove logging evenings and tells of his experiences always in the same style. He believes himself the only real 100 per cent Hoyle, able to tell the world he knows when to play them or when to lay them down. Only the camp cook can remove some of the offensive freshness from this youth. The whistle punk's pet idea of heaven is a trick suit of clothes, with bell-bottomed trousers, a sheik haircut, a flapper, at least $15 in his pocket and a Ford stripped of all but its lungs. Snuff, or Scandinavian dynamite, he carries under his lip and a wad of plug tobacco fills his mouth. On Sunday he adds a cigarette—the badge of the he-man. His boots have the longest and sharpest calks in camp, and when he "stags" his pants legs he stags them four inches higher than any one else in camp. In all these things the whistle punk is collossally "he." But he has one weakness, chocolate bars, his one vulnerable spot. Expose him to a soft brown chocolate bar and you take the wind out of his sails. He is half ashamed to take it but he is helpless.

E. F.

NOTES

The Second Northern Forestry Congress

By Henry I. Baldwin

During the week of July 4-10, 1927, Finland was the scene of the Second Northern Forestry Congress (Andra Nordiska Skogskongress). The first congress was held in Gothenburg, Sweden, in 1923 at the time of the Exposition in that city, and it was then proposed to hold future congresses at intervals of four years. From experiences of visiting foresters at previous forestry meetings in Finland there was no doubt that arrangements would be the best, and when all anticipations were exceeded, it was but typical of the way they do things in Finland. If prohibition was counted an inhibition by some, there was at least an excellent opportunity to appease one's hunger at the five enormous meals which were provided daily.

The congress opened in Helsingfors on July 5, with an address of welcome by Prime Minister Tanner of Finland, followed by Dr. A. K. Cajander, General Director of the Finnish Forest Service. Thereupon Dr. Cajander was elected President of the Congress, and as chairman for the different countries the following: Admiral Arvid Lindman, President, Swedish Forestry Association, Sweden; Prof. Agnar Barth, Director, Norwegian Forest School, Norway; Godseir G. Wilhjelm, Denmark; Senator Oswald Kairamo, Finland; Prof. O. Heikinheimo, Director of the Finnish Forest Experiment Station, was chosen General Secretary. The program consisted of a number of papers dealing with forest problems in Fenno-Scandia, which are to be published in full by the Finnish Forest Experiment Station. Therefore but a brief note on each will be given here.

Prof. K. Linkola, Finland: "The significance of scientific research for practical forest management."

Emphasis on the selection of the proper form of reproduction cuttings, thinnings, plantations, and ditching on peat soils, plantation of exotics, and correction of abuses on farm woodlots.

Prof. A. Oppermann, Director, Danish Forest Experiment Station: "Heredity in forest trees."

The importance of artificial aid from the forester in selecting the best forms of trees to form the new stand, and removing wolf-tree types; illustrated in the case of beech in Denmark. Positive selection is also exercised by the elements, as for example tree forms less adapted to withstand weight of snow will be broken down. It is of vital importance to select races and types of trees which will make the fastest growth and best form for quality for the product desired.

Prof. Agnar Barth, Norway: The Norwegian Forestry Association's activity and the results thereof."

A sketch of the history of the association and description of its activities in planting; illustrated by lantern slides.

Jägmästare Alfred Wigelius, forester for the Forest Society of Southwest Sweden, Gothenburg: "The origin of well-managed communal forests; an important development for economics and conservation."

In co-operation with the towns and counties in southwestern Sweden over 100,000 hectares (240,000 acres) have been planted to forest during the period the society has been at work. Most of the plantations have been made on heath lands cleared during the Middle Ages in wars with Denmark.

Dr. Erik Lönnroth, Finland: "Present questions of regulation in forest management."

Owing to the uneven age class distribution in Finland, with much over-mature timber in the far north relatively inaccessible, and an excess of young and middle-aged classes in the central part, regulation of the cut will be difficult until the virgin forests have been cut through. Lowered rotations will be necessary in many places.

Following the congress proper with its accompaniment of dinners in and about Helsingfors, the visits to fortresses in the harbor and ardent silvicultural discussions on the Esplanade, a three days' excursion was made to central Finland, where various experimental forests and wood-using industries were visited. The traveling, and such sleeping as was possible on those light, balmy nights, was accomplished in a special train of sleeping cars between midnight and 7 A.M. daily. The first visit was at Raivola, near the Russian frontier, where the Finnish Forest Experiment Station has taken over an area of old larch plantations and the surrounding natural forest. This area is interesting chiefly as an example of what reforestation can produce on suitable soils.

At the instance of Peter the First of Russia, a German forester named Fockel undertook the cultivation of Siberian larch (*Larix sibirica*) in 1783 as a reserve for the Russian navy. The first stands were established by broadcast sowing after burning and harrowing the ground in May of that year, and are thus 189 years old today. Other areas were sowed in furrows two feet apart. A few years later other areas were planted with plants thinned from these rows, making the plantations the same age. These plants were spaced 13'x13'. Later stands with the same spacing date from about 1770. Altogether about 20 hectares (50 acres) are now clothed with larch, and scattered individuals of this species are found over an area of 103 hectares (about 250 acres.) The whole experimental forest has now been enlarged to include 5,500 hectares (14,200 acres).

This forest lies on the boundary of the central Russian oak region, and the coniferous zone of Fenno-Scandia. The precipitation averages about 624 mm. (25 inches), and the mean annual temperature 3.4 degrees C. Broadleaved trees are in leaf for about 141 days annually. The soil varies from a heavy clay mixed with sand in the moist dales to typical morainal gravel on ridges. According to Cajander's forest type classification (1) most of the larch-bearing land belongs to the *Oxalis-Maianthemum* type (OMaT) and *Oxalis-Myrtillus* type (OMT) Morainal soils belong mostly to the *Myrtillus* type (MT). During the excursion it was rather difficult for foreign participants to distinguish offhand between the first two types, and at no time during the excursion was any explanation of this system of classification offered. It is taken for granted in

Finland, and in general use in public and private forestry. Besides the common Scotch pine (*Pinus sylvestris*) and Norway spruce (*Picea excelsa*), pedunculate oak (*Quercus pedunculate*), Norway maple (*Acer platanoides*), elm (*Ulmus montana*), linden (*Tilia cordate*) and hazel (*Corylus avellana*) are found growing wild in association with the planted larch.

Prior to the taking over of this area by the Finnish Forest Experiment Station it had been cut heavily by the Russian government, especially by the St. Petersburg Fuel Commission during the war, without, however, touching the larch. This has grown up essentially without thinning or disturbance of any kind. One sample plot, composed chiefly of larch, has a total volume of 1,928 cu. meters per hectare (28,212 cu. ft. per acre) with dominant trees 40-42 meters (131-138 ft.) in height. There are 1,350 stems per hectare (540 per acre). Over the entire larch area the average stem per hectare is 748 cu. meters (10,561 cu. ft. per acre) for larch alone, which makes up but 45% of the stand by volume. The trees are impressive; great columns free of branches for two-thirds of their length, with tops slightly bent and crowded, twined over a still lofty understory of spruce and pine. Wind has taken its toll of trees which have been spared by the axe nearly 200 years. Possibly judicious thinning would have made them more windfirm. As it is larch apparently has quite an adaptable root system, showing three distinct types of branching in these stands, first the surface type, as in forest-grown spruce, second a so-called normal type of symmetrical branching, and third, a peculiar forking type, which at Raivola takes advantage of fissures in the clay soil to get down to deeper layers. The heaviest windfall occurs with the superficial root system on clay soils. Fungi also play a part, *Trametes pini, Polystictus Schweinitzii* and *Fomitopsis annosa* having aided in weakening the roots. (2) At present the larch stands are being preserved as a curiosity and an example of what the land will produce. Where trees must be taken out their place is being filled with underplanted ash and Douglas fir, and extensive plantations of larch in the vicinity are intended to take the place of the veterans in the future. As much as 4,000 markka ($100) has been received for a single tree salvaged from the old stands for radio masts, and there is no lack of other markets for the wood.

After an evening in historic Viborg, the largest lumber export center in the Baltic region, the excursion moved on to Punkaharju.

Punkaharju might be said to be a product solely of continental glaciation, but its peculiar topography has been utilized by Czar and Bolshevik for military purposes and now finds peaceful expression in a combined tourist resort and research forest. Here, according to Prof. Tor Jonson, Scotch pine attains its best development. Hogbacks, several miles long and but a few hundred feet wide, wind through the ramifying lakes—the central part of Finland contains more water than land—their sides clothed with copper-red pine stems, each one straight enough for a flag-pole.

The climate differs little from Raivola: 548 mm. (21 in.) rainfall with a maximum in August, and a mean annual temperature of 2.4 degrees C. The soil for the most part is coarse glacial gravel, although several flats with plenty soil and admixed sand allow the cultivation of more exacting tree species. As can

be inferred from the soil character, a large portion of the Punkaharju region belongs to the *Vaccinium* type (VT). The total area of the experimental forest is 505 hectares (1,212 acres).

A large forest nursery is maintained on the forest for raising planting stock, much of it of exotics, for making test plantings. Here may be seen, among others, lodgepole pine (*Pinus Murrayana*), Siberian fir (*Abies sibirica*) and stone pine (*Pinus cembra*). It is of interest to note that seed beds are covered with a sort of parchment paper, held down by wooden strips and stones, which causes an effect similar to that of the glass roof of a hothouse, conserving moisture and heat, and hastening germination. It probably transmits more ultra violet rays than glass. This system makes possible marked economies in the use of seed, satisfactory Norway spruce beds being secured with 1.5 kilos seed per 100 sq. m. as against 10 to 12 kilos, which, it was claimed, is frequently used in central Europe. When germination has fairly begun, the parchment is removed during the night, or a light rain. Plants are subsequently protected by lath screens. Many of the plantations are now upwards of 30 years old. Siberian fir shows promise of becoming a valuable species in this region; it has heavier foliage, but otherwise resembles balsam fir not a little. Perhaps the most interesting plantation was that of Siberian larch set out 50 years ago from seed from the Riavola larches. Four-year-old plants were used. Forstråd Montell, who did the planting, was present and related in detail how the trees were set, and then addressed his trees personally in a very pleasing and amusing oration.

At this stage in the day's program the entire company availed itself of an opportunity to bathe in a nearby lake, which gave welcome refreshment from the steady heat of the long day. Nevertheless, when the multitude again gathered about a sandwich table spread beneath the trees it was rumored that a record number of bottles of prohibition beer were consumed.

Most of the natural stands in this part of Finland, pine for the greater part, are middle-aged or younger, and have arisen following shifting cultivation (svedjebruk). An opportunity was given to see how a crop of rye was combined with pine reproduction by this method. The forest experiment station finds it an advantage to continue this combination of primitive agriculture and forestry on a small scale, in order to study the effect on soil and growth of the stand. It is still recognized as a possibly good method of silviculture in some sections of Finland, and forestry students are required to learn it. In the vicinity of Punkaharju farmers are glad to pay 100 markka ($2.25) per hectare annual rent for the privilege of raising a crop of rye. After all timber has been cut the resulting slash is burned broadcast in July of the year following cutting. The soil is then ploughed, or rather scratched with a crude homemade plough and then harrowed by dragging it with a spruce log armed with protruding branch stubs, a "branch harrow" (kvistharv). Rye is sown in August at the rate of 1 hectoliter per hectare, and the following spring 3 kilos of Scotch pine seed per hectare. Sometimes the pine seed is broadcasted on the crust late in March and only one kilo per hectare used. The farmer who does the cultivation supplies the pine seed and fences the area, so that the state secures reproduction not only without cost, but as a profit. It is said that the farmer

often realizes 2,000 markka ($50) net profit per hectare from the rye. When the pine germinates it is protected by the partial shade of the rye during the first year. After the rye is harvested, the pine, which has been protected by the stubble during the harvesting, can grow without hindrance from competing vegetation because the rye has killed out all weed growth and sod. In some places birch seed trees are left over the rye to provide the desired mixture of birch in the new pine stand. Of course, where the soil is suitable two or more crops of rye may be raised before recommencing a forest rotation. It is said that much of the southern and central Finland has been cropped in this way for 500 years, with perhaps three croppings per century.

The excursion now continued by water up Lake Saimen to Nyslott, where the ancient castle of Olofsborg was visited; thence to Niittylahti for an inspection of one of the forests of the Kymmene A/B, a pulp and lumber company. Pine was again the dominant species, and reproduces naturally unusually well on this site when mature stands are gradually opened out. Scandinavian foresters were quick to recognize it as easily regenerated pine land. The forest belongs to the *Vaccinium* type (VT) and has just completed one 10-year period under intensive management. Regulation has so far attempted only to cut through the area and bring about a more even distribution of age classes. During the last 10-year period much overmature timber has been removed, and during the next thinnings and preparatory shelterwood cuttings will predominate. The company has over 800 permanent sample plots laid out on their holdings for determining the current growth. Many of these were visited.

From here the excursion made its final call at the Varkaus pulp and paper mills, the most modern in Finland, if not in Europe. The ground wood mills are equipped with the new German Heidenheim automatic-feed ground wood machines. After a few farewell hors d'oeuvres and other nourishment, the congress broke up, some members to make further special excursions, while the main party returned to Helsingfors.

To a foreign visitor perhaps the most striking impression left by this gathering is the immense forestry interest in Finland, and the huge accomplishments in the short time since the country's independence. Americans are already familiar with the productive forest literature which has emanated from this small country. There are now no less than 16 research forests, covering a wide range of conditions, maintained by the Finnish Forest Experiment Station. The station itself is now to be enlarged to include six subdivisions. While the criticism was made that the best was shown the congress, and that "there is no forestry back of the main roads," it must be remembered that well-regulated forestry is still young in Finland. Most of the large company lands are now being organized on a sound basis, and the present overcutting in some regions is bound to be equalized as time passes. Finland hopes to bring still more encouraging reports to the next congress in Norway in 1931.

(1) Cajander, A. K. A Theory of Forest Types. Acta Forestalia Fennica 29, 1926.

(2) Heikinheimo, O. Myrskytuhoista Raivolan Lehtikuusimetsässä (Über die Sturmschäden in dem Lärchenwalde bei Raivola am 23 Sept., 1924), Communicationes ex instituto quæstionum forestalium Finlandiæ editæ 12, 1926.

Clear Lumber From Commons

By Emanuel Fritz

A very important obstacle to the practice of forestry on private cut-over lands is the low average grade of lumber produced by "second-growth" coniferous timber. As a rule the knots in such lumber are so numerous and often so defective as to render it unfit for any cut common lumber uses. At the same time the stumpage value is brought so low as to make forestry unattractive to private owners. The future for second-growth lumber, however, looks brighter since the perfection of a machine designed to bore out knots and ream out knot holes and replace or fill them with sound, tight plugs of clear lumber. Common lumber is thus given the utility of clear lumber except possibly where natural finishes are required. Four machines have already been built and are soon to be put into use in several western mills for raising those common grades carrying knot holes and defective knots to grades of considerably greater money value and utility. The increase in value in some grades of certain species may thus be as much as $20.00. The cost of replacing the knots will be well within this figure, thus allowing not only a fair margin of profit but creating a wider field for the lower common grades.

The machine was invented and developed by Mr. Homer E. Leash of Niles, California. It is rather simple in design and takes up a floor space of about four feet by four feet. It resembles a drill press or small boring mill but has a spindle below the table as well as above it. Briefly, the board to be "plugged" is so placed that the knot is in line with the vertical spindles. The board is clamped to the table, a push button starts the lower spindle to rotating and rising, carrying with it a cutter head. The main cutter in rising bores out the knot and leaves a smooth hole, but it is immediately followed by a saw-tooth cutter which cuts a screw thread. After passing through the board and completing the thread the spindle is stopped, a square block is placed upon its head and held there tightly by the upper spindle which is dropped down upon it. The spindle is then reversed and as it recedes through the hole the square block is cut round and threaded by cutter heads placed to one side of the center and above the table. As the block is thus reduced to a threaded plug, the spindle continues to revolve and recede carrying the plug with it and into the hole. The machine can be made to stop automatically when the plug and board are flush with one another and the grain of the plug parallels that of the board. A board thus plugged may be resawed and surfaced without danger of the plugs loosening or falling out. No glue is necessary, as the fit is very snug. Paint, as ordinarily applied, hides almost completely every evidence of the plug except, perhaps, a very fine circle marking its outline which, however, is not at all conspicuous. The machine is adequately illustrated and additional details appear on page 138 of the August, 1927, *Timberman.*

When the writer first made the inventor's acquaintance, about five years ago, and then showed samples of his work to lumbermen, the idea was met with some jocularity and ridicule, but the attitude toward this machine is now completely reversed and much interest is being displayed in its possibilities. Present day use of this device and process will be limited to low grades of old-

growth lumber to make them suitable for boxes, shelving, house siding, cornice boards, and even interior millwork where it is to be painted. When second-growth timber begins to assume greater prominence in our lumber markets and clear old-growth lumber reaches the status of being a curiosity, "plugged" boards may well be expected to "carry on" in such uses where only the clear grades are now used. The significance to forestry and to the future dominance of lumber in the building industries is obvious.

Private Forestry in Finland [1]

The new northern republic of Finland is one of the most densely timbered countries in Europe. Forests cover over 73 per cent of its total area. According to the investigations recently made by the Finnish Government, the growing stock of the forests can be fairly accurately estimated at 57,213,000,000 cubic feet, with an annual increment of 1,658,000,000 cubic feet. In contrast, Sweden, it is interesting to note, hitherto better known than Finland as a timber-exporting country, has an annual growth in her forests of only 1,267,000,000 cubic feet. Of recent years, however, Finland has become the largest exporter of timber in Europe. She cuts about 1,490,000,000 cubic feet of her timber annually, but fortunately for the Republic, even this huge total is considerably less than the annual growth in her forests.

The great forest resources of the country have had the effect of making the export of timber and its products the main industry of Finland. The most outstanding and progressive Finnish firm engaged in this industry is Aktiebolaget W. Gutzeit and Company, of Kotka, which has won a European reputation for their timber, wood pulp, cardboard, paper, etc. This great concern owns seven sawmills and ships annually from the port of Kotka some 84,000 Standards, (nearly 14,000,000 cubic feet) of sawn woodgoods. The sawmills require about 3,700,000 logs every year; other wood-working mills owned by the company consume 22,000,000 cubic feet of grinding and pulp wood. In order to secure the necessary raw material, Gutzeit have from time to time purchased wide areas of forest land, with the result that they now own more than a million acres (an area considerably greater than the County of Kent) and are thus the largest landowners in Finland. Their forests are estimated to contain about 50 per cent Scots fir, and 25 per cent common spruce, the balance consisting of 20 per cent birch and 5 per cent aspen and other trees.

The forests consist for the most part of young trees and trees in middle growth; these, of course, show a large annual increment, the more so because the soil on which they are growing is the best in Finland. When these forests mature, the firm will be in a position to take the greater part of its timber requirements from its own lands. It should here be pointed out that losses through forest fires in Finland are practically negligible, owing to the wonderful network of rivers and lakes, which prevents the fires from spreading.

In compliance with the State forestry laws, Messrs. Gutzeit carry on extensive re-forestation, and every year many hundred of thousands of seedlings are planted out in existing forests and on suitable land elsewhere. Most of

(1) Prepared in the offices of Price & Pierce, London.

the seedings naturally are of species indigenous to the country, the majority being spruce.

According to Government statistics, the average timber content of Finnish forests as a whole is about 906 cubic feet (solid measure) per acre, and the annual increment 26.7 cubic feet per acre. The corresponding figures for Gutzeit's forests are at least as high as these.

The district from which their raw material is drawn is in east and southeast Finland, and comprises an area considerably larger than Ireland. The firm divides the district into five areas, each of which is under a forestry officer, who not only superintends Messrs. Gutzeits' own forests, but is also responsible for the logs bought by the firm from other landowners. These areas are subdivided into smaller sections managed by district foreman, who are in charge of a large staff of local foremen and foresters. The whole of the forestry organization is controlled by a forest department, at the head of which are two chief forestry officers.

The majority of the logs are transported from the forests to the sawmills by water, and most of them reach the mills in the course of one floating season. Some 20 per cent of the log-get, however, which comes from the more remote forests, does not arrive at the big mills (at Kotka on the south coast) in one season; these logs lie in the frozen waterways over the winter, and take about eighteen months to complete their journey. Floating of the pulpwood on the other hand is always completed in one season, for most of the firm's pulp and other mills, are situated nearer to the forests. The average transport distance of the logs from forest to mill is 340 miles. The outskirts of the forests are in no case more than four miles from the nearest waterway, indeed the average distance is less than two miles. Over this comparatively short distance, the logs are conveyed by horses and tractors.

Gutzeits' transport department is responsible for all matters relating to water-transport. In this work they make use of sixty-five tugboats, several hundred steamers, motorboats, barges, etc. The company owns docks and machine-shops in Nyslott, where necessary constructions and repairs are effected.

A Glance Around

By Carlos G. Bates

During the season just closing I have had the privilege of a trip through the West, and a glance at a portion of New England. From the great mass of impressions that one would naturally obtain in seeing so much essentially new country, the following are outstanding. Please remember that I am listing these *merely as impressions*, for what they may be worth, and in no sense as critical discussions:

1. The fact that Arizona as a whole is being grazed to the roots, and the stock industry is gradually annihilating itself.

2. The great importance of fire in the southern California brush-fields from the standpoint of erosion and that absolutely vital resource, water supply.

3. The stupendous possibilities of redwood growth within its natural climatic belt, where satisfactory sprouting is obtained.

4. The oft-repeated evidence in California that the distribution of a species may have been limited by events long past, even more plainly than by existing soil and climatic factors. These same events, through segregation, have doubtless led to multiplication of species, as, for example, the several forms of hard pine.

5. That the fast-growing, second-growth Douglas fir offers little help on the problem of quality lumber, though it may furnish an abundance of common dimension.

6. The striking similarity of the yellow pine type east of the Oregon Cascades to that of the Coconino Plateau, although the former, because of lack of water and of grazing, has practically no reproduction problem.

7. That pure stands of western white pine in northern Idaho, without their component of inferior species, are largely out of the question, and that we may as well learn to swallow the sour with the sweet.

8. That an enormous area of New England is coming up to mixed growth of low average quality, which can only be made profitable through severe clearing. The status of eastern white pine is especially disappointing, and for many reasons Norway pine looks like a better proposition for light soils.

9. That whether we are talking about eastern or western white pine, Douglas fir or redwood, current impressions of second-growth are based on quantity production without regard for quality; that nature's time for quality production cannot be greatly shortened, though the process may be somewhat modified; that the future of forestry hinges on quality production, for without it one man's cellulose will be as good as another's.

C. G. Bates

Forest Research Fellowships

The Forestry Committee of the National Academy of Sciences met in Washinton on Friday, October 7. In addition to the members of the Committee a number of members of the Society attended the meeting by invitation. The purpose of the meeting was to discuss the proposed plan for the creation of fellowships in forest research. The Committee indicated that it was prepared to endorse the general plan and at a meeting the following day specifically requested the Society to appoint representatives to confer with the Academy Committee and prepare a detailed plan for the creation and administration of these fellowships. This work will be undertaken immediately.

Erratum

On page 752 in the third line of Section 5 (just above the middle of the page), the phrase "For collecting all monies due the Society," should be inserted after the word, "Society," and before the phrase, "which he shall deposit and expend as directed by the Council."

SOCIETY AFFAIRS

California is Calling

The Annual Meeting of the Society to be Held at San Francisco, December 16-19

A Conference of Forest Schools will precede the Meeting

For the first time in the history of the Society the annual meeting will be held in the West. This will be a significant occasion, not only because of this break in tradition as to meeting place, but because equally of the growing importance of the West in American forestry and of the opportunity which it will give for realization of the desire of most eastern foresters to see the redwoods, the "forests of the giants" and the colorful city of the gold Argonauts which lies so close to them.

The foresters of the West feel their responsibility for this meeting very keenly and, through both the Meeting's Committee of the Society and the California section as hosts, are uniting in an endeavor to make the meeting a memorable one for the whole Society and one worthy of the long journey required of the Eastern members to attend.

The program of the meeting will be the following:

December 15—CONFERENCE OF FOREST SCHOOLS.

December 16—SOCIETY OF AMERICAN FORESTERS SESSIONS.

Morning

9.00 Welcome, Response, etc.

10.00 Subject: INDUSTRIAL FORESTRY IN THE WEST.

1. The Industrial and Commercial Growth of the Countries bordering the Pacific Ocean and their Increasing Dependence upon the Natural Resources of the Western United States.
2. The Rôle of Western Wood Production in Supplying the Future Markets of the Nation and the World.

Afternoon

2.00

3. Industrial Forestry in the California Pine Region: What is being done. What Can Foresters do to forward it?
4. Forest Land Management by Private Owners in the Douglas Fir Region; Present Tendencies, Obstacles to Forestry Practice and Suggested Remedies.
5. Industrial Forestry in the White Pine Region of Northern Idaho; Its Progress and Difficulties.

Evening

6.30 Dinner

8.00

6. Presidential address:

A Forest Program for the West from the Point of View of National Needs.

December 17

Morning

9.00 — 7. The Redwoods: What Factors Favor or Retard the Practice of Forestry in the Douglas Fir and White Pine Regions, in Comparison with the Redwood Region?

8. Industrial Forestry in the South and West Compared; What Lessons Can Each Teach the Other?

9. How National Forest Administrative Policy Affects Industrial Forestry: Co-operative Relationships, Timber Cutting Policy, Management Plans.

10. Summary and Outlook for Industrial Forestry.

Afternoon

2.00 — 11. The Forester's Part in Flood Control.

3.00 — Society affairs.

Reports of Secretary, Treasurer, Membership Committee, Executive Council.

December 18, 19, 20.

Field Trip to Redwoods.

This program represents primarily an endeavor to bring out the accomplishments and present status of private forestry, or what Greeley has called "industrial forestry," in the West, and to emphasize its significance and bring out, through the meeting, what should be its direction and development.

The framers of the program believe that the first requisite for a competent guidance of private, as of public, forestry is an understanding of the economic situation toward which, as a part of the larger world, we are headed, and which must fundamentally condition the future of the forestry enterprise, both in the West and in the nation, through the complex shiftings of forest supplies and of the production and consumption of forest goods, both at home and abroad.

Such a comprehensive program calls for presentation by speakers of the largest caliber and ripest judgment, and the Society can confidently expect the best obtainable. The speakers are still under negotiation and cannot therefore yet be announced in full. The first topic on the program, however, it is hoped, will be presented by one of the outstanding figures at the recent Pan-Pacific Congress at Honolulu. His interpretation of the widely expected shift of economic world supremacy from the countries bordering the Atlantic Ocean to those bordering the Pacific and his appraisal of its probable effect upon the American people will supply the larger setting and background for the specific discussions of forestry practice and prospects which follow.

For the banquet on Friday night there will be important speakers to make the occasion memorable, and treats in lighter vein promised by the Entertainment Committee.

The field trip to the redwoods will be important to every forester, not only because of the wonderful forests there but because of the unique industrial development to be seen of actual forestry practice, committed to the ideal of sustained yield as a presently feasible commercial project. Arrangements for this field trip (weather permitting) will provide it at the least possible expense to the

members. Transportation will be by auto, without cost to those participating in the trip, and the only charges necessary will be meals and one night's lodging.

An important complement to the Society meeting will be the Conference of Forest Schools, on December 15, immediately preceding the Society sessions, called by Dean Walter Mulford of the Division of Forestry, University of California.

The California section is making every preparation, as host, for the comfort and entertainment of its guests. Excellent hotel accommodations will be available at reasonable rates, probably from $2.50 with private bath and $2.00 without, upward. Entertainment, and shopping and other conveniences for visiting ladies are being planned by a Women's Auxiliary of the section. Every effort is being put forth to make the meeting, and the sojourn in California of the meeting attendants, the most profitable and enjoyable possible.

Each Society member will be sent an individual letter giving full details and the complete program, with speakers. Any inquiries should be addressed to Dr. E. P. Meinecke, General Chairman, U. S. Forest Service, Ferry Building, San Francisco.

Come with us and help make this meeting the best annual ever held.

Here is a Chance to Serve the Society

This section of the Journal needs help. Suggestions, news, changes of location and work, interesting places, forestry operations or equipment manufacturers to visit, honors bestowed on members, unusual trips proposed by members and instances of making money out of forestry—all of these things fade out of your mind and are lost to the readers of the Journal unless you send them in promptly. Write them in pencil, use the back of an envelope if nothing else is handy and for the sake of all that is American, don't get a modesty complex and leave out what happens to yourself. With no intention of being undignified, I'd like to dare the membership to send in just one piece of news about some member for the December issue. There might be duplicates but every note will be read and used entirely or briefed for publication if I have to get the entire Washington section to help.

Emanuel Fritz calls attention to the following charge to new members used by W. F. Durand, at the 1926 annual dinner of the American Society of Mechanical Engineers: "We of the membership of this Society deem such relationship no small privilege, no small opportunity, but we cannot separate honor and privilege from responsibility and obligation. It is a law of all human relation, a law indeed of life itself, inevitable and inexorable, that if we would enjoy and profit by privilege and opportunity, we must in return accept collateral duty and responsibility. So if you would enjoy and profit by what our Society has to offer, you must in turn be prepared to accept the duties and the responsibilities which are the inexorable compensation which must be rendered in return."

I dare you.

Shirley W. Allen

1523 L Street, Washington, D.C.

A Howl From the Wilderness

By G. C. Hawkins, F.E., Winchester, New Hampshire, Forester for The New England Box Company which operates ten factories and owns large timber holdings throughout New England.

At an informal meeting of the New England Section held at New Haven recently, the Executive Council of the Society gave the section an opportunity to express its views regarding the Journal, the advisability of having a paid Secretary and of the Society itself.

Some of the members present expressed their opinions in no uncertain terms and they were not particularly complimentary. Everybody present including the members of the Executive Council was willing to admit that the Society was at least sick—and some thought it had gone well on its way to the "Happy Hunting Grounds," to put it mildly.

It seemed to me that the Executive Council was really anxious to discover what was wrong and was making an honest effort to locate the "pains" so that the proper remedy might be applied. Far be it from me to recommend castor oil in such a case but I do think that if each member could be "loosened up" to tell where he felt the worst and not merely sit back and say he wouldn't have a Doctor something might be done to alleviate the suffering of our little family—there are only 1,330 of us.

What's the matter with you fellows out in the Middle West? How about you fellows down South? Have you got the same "dis-ease" that we cusses up in New England have or have you just got a mild mental trouble?

Why not give Stuart, our new President, something to think about? Let's do something! Let's get some real red blood flowing through our veins. Let's put the Society onto its feet—before we find it and ourselves six feet under the sod.

Someone cracked a good one at New Haven. It seems the flea was hustling aboard the ark and feeling a gentle but firm pressure from the rear, turned to see the elephant just behind him, whereupon he hollered to the elephant, "Who in hell do you think you're pushing?" I say, fellows, let's make someone ask us that question.

How?

My contribution will read like this:

I have a pain somewhere around my heart. It feels like growing pains. Can't you help me?

First symptom: Journal of Forestry No. 7, November, 1926

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On page 833 of the same issue, next to last paragraph, read this: A large proportion of our forest land is owned by estates, banks, corporations, and

business and professional men of means. Many of them will be glad to practice forestry to some extent if they are shown that it will pay—and they can be shown.

Suggested prescription: Instruct editor of Journal to have one article in each number of the Journal setting forth how—"they can be shown."

Second symptom: Much discussion and more written about academic and theoretical "branch" of the art of Forestry. Reference: Journal of Forestry No. 4, April, 1926, page 331 first line. "If words would make trees grow, the United States would be the most thickly wooded country in the world."

Suggested prescription: Major operation. Removing small part of the present unuseful verbosity and by diligent exercise developing that part of Forestry which is struggling in the woods to MAKE LUMBER OPERATIONS SAFE FOR FORESTRY. Dig up some dirt foresters, if there are any, and let's see and hear what they are doing or trying to do.

Third symptom: Last meeting of New England Section. Devoted to regular business of Section and discussion as to how to save Parker Young Company the necessity of lumbering Waterville, a 22,500 acre tract of White Mountain scenery, and place same responsibility on the U. S. Government

Suggested prescription: Devote one-quarter of the section's time to discussion of practical Forestry, in the woods. Follow out Ward Shepard's idea of "The Necessity for Realism in Forestry Propaganda" as set forth in his Pack Prize article.

Don't get me wrong. I too, am sentimental about the woods. I built my home in the woods. I literally live in them. But I have to be practical part of the time so that I can afford to be sentimental the rest of the time.

. . . .

In my opinion these activities with the many others that you men from all over the country will suggest to our President, if he tells us about them, will convince the whole of us that we need a paid Secretary who can devote all of his time to looking after our health.

"Between the great things
we cannot do, and the small
things we will not do, the
great danger is, that we
shall do nothing."

New York Section Meets at Cranberry Lake

Sixteen members and six guests attended the summer meeting of the New York Section at the State Ranger School at Cranberry Lake, New York, on August 29-30 at the invitation of the New York State College of Forestry.

The first afternoon was given over to a field trip to points in the Pack demonstration forest including the meteorological stations maintained in cooperation with the Northeastern Forest Experiment Station for the study of forest fire weather, and a wooden fire tower erected by two students. Accommodations in true forester style were provided at camp through the able management of Director G. H. Lentz and the evening session was full of good committee reports and spirited discussion. Chairman O. M. Porter presided.

The membership committee proved that it had been busy canvassing the field for new members and reported action on eleven names since its appointment last March.

The committee on Survey of private forestry was continued with G. H. Lentz as chairman and plans made to speed up the work. Favorable discussion of the McSweeney Bill ended with reference of the measure to the State Policy and Legislation Committee with power to act. President Stuart spoke briefly on the activities of the Society and J. F. Preston's spruce production proposal was presented by the author, discussed and referred to a committee for further action. It was voted to request the Executive Council to submit the matter of increased dues in a ballot to the society.

J. N. Speath gave an informal report on the First International Soils Conference and Dean F. F. Moon spoke on forestry education.

On the second afternoon the visitors went to the State Ranger School by motor boat, inspected the new building which is nearing completion and also visited the nursery, liberation cuttings and other experiment plots.

Director J. S. DuBuar, of the Ranger Schools is credited with arrangement of an unusual program and the crowd broke up with a determination to be on hand at the winter meeting in Albany early in February.

Notes About Society Members

Sam Dana left the Forest Service, August 15, and is now Dean of the new School of Forestry and Conservation at Ann Arbor. Back of Dana lie eighteen years of tireless and constructive Forestry effort in numerous positions including Forest Assistant, Assistant Chief of Research and Director of the Northeastern Forest Experiment Station in the Forest Service, and Commissioner of Forestry in Maine. His service to the Society is well known and he has been hardly less active in other scientific bodies including the International Forestry Congress. Ahead of him lies a fine opportunity for service among young men, politicians and idle acres and he says he is having a good time.

John S. Boyce succeeds Dana as Director at Amherst. He hails from the old Nebraska Forest School and Stanford University and for the past few years has been head of the Portland, Oregon, office of the Bureau of Plant Pathology. He entered the Forest Service in 1912, and shortly afterward became a Forest Pathologist.

Ernest G. Dudley, sometime Forest Assistant, Extension Professor at Syracuse, and now militant forester in the San Joaquin Valley, California, while he rests from long daily activity as a rancher, says he is always glad to see a forester at Exeter, California, his home. He is active in state conservation matters and still more than just a forester at heart.

Colonel W. B. Greeley is now a Doctor of Laws, this honor having been conferred upon him by his alma mater, the University of California, last May. In conferring the honor, President W. W. Campbell cited Greeley as "creator of woodlands: aider and abetter of nature . . . . and self-sacrificing servant of his fellow men."

R. R. Fenska will put in his sabbatical year from Syracuse as forester for the Massachusetts Forestry Association. His address is 4 Joy Street, Boston.

Two members of the Society are lined up in the newly organized trade extension staff of the National Lumber Manufacturers' Association. A. T. Upson

is in charge of the New York office in the Graybar Bldg., Lexington Ave., and 43rd Street. Upson has done remarkable work with the Association in lumber standardization. F. V. Fullaway of the Missoula office of the Forest Service is in charge of the Portland, Oregon, office. L. N. Erickson is with the Washington office of the Association, taking over some of Upson's work in waste prevention.

E. F. McCarthy is established as Director of the new Central States Forest Experiment Station at Columbus, Ohio.

Henry H. Tryon resigned as extension Forester in South Carolina, on September, and is now forester on a large wooded estate near Cornwall-on-the-Hudson, New York. Tryon will work out a management plan for the forest, operate a sawmill and develop the wild life resources of the tract. His address is Box 518 at the above village. He went back to South Carolina after leaving and won a case as expert witness against a fire trespasser.

Michigan Conservation Commission Loses Young

Following an executive meeting of the Michigan Conservation Commission on October 5, announcement was made of the resignation of Director Leigh H. Young, who was appointed last January by Governor Fred W. Green.

It is understood that Young did not approve certain of the acts and policies of the Commission and that he refused to conform on matters which he felt were not good conservation. His resignation was requested by Governor Green and was first offered, it is said, on September 19.

William H. Loutit of Grand Haven, has been named Executive Director, temporarily and George Hogarth, former Secretary of the Commission, acting Director. Mr. Loutit will spend as much time as possible in Lansing, but has business interests which occupy him rather fully. Neither of these men, it is understood, are trained in any phase of conservation.

The reorganization of the Commission is rumored to be the outcome of an upheaval following the death of the late James Oliver Curwood, who was one of the Commissioners and who was out of harmony with the Director.

Young has returned to his work as Professor of Forestry at the University of Michigan.

Suggestions From John D. Guthrie

The following comments are meant in a constructive way and are sent you for possible consideration by the Executive Committee.

Ballots—Officers.

On the annual ballot sent out, on the portion giving names of nominees for executive committee, there is no mention of the *number* of men to be voted for, while usually several names are given. Ballots from other scientific and military organizations to which I belong *always* state the number to be voted on. I was asked this fall by at least six members (including three District Foresters) "how many members for the Executive Committee are to be voted on." I called the Secretary's attention to this on the 1925 ballot.

Method of Dropping Delinquent Members.

Some improvement seems to be needed in the system used. I know this, that in several cases in this section, there has been considerable misunderstanding on the part of the "delinquee" and a retreat from the original position of the Secretary was made. There are several men in this region who refuse to re-enter the Society on account of the stand of the Society on delinquent dues. If a man is required to pay several years back-dues before being allowed to re-enter, then he should be given something to show for his dues paid, at least complete file of the Journal for the period for which he pays. There seems to be too long a time between beginning of delinquency and final dropping a man's name. Examples are E. T. Allen, R. H. Chapler and several older cases. Chapler was told at first he owed $16.00 and finally $8.00. Allen was informed he owed more than the final amount he was told he owed. There seems to be a lack of definite policy, or if there is a definite policy, departures have been made from it.

Paid Secretary

This question has come up from time to time. I do not believe that the Society at this stage needs or can afford a Secretary whose function would be to visit the different Sections. Rather I believe the solution is the employment (on part time, or full time basis as needed, or as funds are available) of an efficient woman clerk to handle all correspondence and clerical matters; this should relieve the Secretary of the bulk of routine work which must be heavy.

Membership and Increased Dues

I find very general opposition in this District to large increases in dues, and a large number of members stating positively that they will resign should the dues be increased to $10 or over. Theoretically, at least, every technical forester should be willing to support the Society by becoming a member; professional pride if no other reason should dictate this. Unfortunately, this is not the case in too many instances. There are probably ten to fifteen men in this District fully qualified for senior membership who are not members. When approached, as they have been more than once, they ask: "What do I get out of membership? the Journal, yes—that is all." "What does the Society do to help its members other than publish a Journal? How active is the Society in local and national forestry movements?" It must be admitted that these are pretty practical questions, and none too easy to answer satisfactorily.

I believe that this situation, as well as the financial one might be helped by adopting some of these suggestions below, originality for which is not claimed.

Memberships

I believe we should have a greater number of membership grades with dues as follows:

Honorary—no dues	
Junior Member .... $	3.00
Associate	4.00

Member	5.00
Senior Member	6.00
Fellows	15.00
Life Members	100.00
Patron	1,000.00

A Junior Member classification was considered a few years ago, to include seniors (or both juniors and seniors) in forest schools; I believe this grade has possibilities in enlisting the interest of the young forester while still in school and that many, once in the Society, would continue their membership through the grades. Dues for Life Member might be even more than $100.00, and open only to Senior Members and Fellows. There may be men sufficiently interested in forestry to become Patrons, at $1,000. Fellows, though there are not many, should pay and can afford to pay much more than Senior Members. I believe this classification would result in a larger membership with consequent greater revenue to the Society.

Positions Wanted Page

The Journal might well carry a page for foresters wishing positions or change of location. This should be carried free, or at most for a nominal charge. It would evidence a practical interest of the Society in the welfare of its members.

Number of Journal Issues Per Year

While I can not say as to any difference in cost, I should prefer eight *larger* issues rather than twelve issues annually, since most foresters, I believe, find little time during the summer season for much reading, whether they are in Federal, state or private employment. There is an ever-increasing amount of forestry material (I will not call it literature!) to be read.

Extracts from the Journal

I still hear complaints made as to the high cost of extracts from the Journal as compared with other scientific and engineering publications. I wonder if all publishing possibilities have been gone into.*

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* With the present prices for reprints (see publishers' statement in the back of October issue) there should be no further complaint about their high costs.—ED.

Sections of the Society of American Foresters for 1927

Allegheny

F. W. Besley, Chairman, 1411 Fidelity Building, Baltimore, Md.
J. H. Preston, Vice-Chairman, c/o Hammermill Paper Co., Erie, Pa.
H. F. Round, Secretary-Treasurer, Forester's Office, Pennsylvania R. R. Co., Philadelphia, Pa.

California

C. L. Hill, Chairman, 1408 Grand Ave., Piedmont, Calif.
F. S. Baker, Secretary, 305 Hilgard Hall, Berkeley, Calif.

Central Rocky Mountain

E. W. Tinker, Chairman, Forest Service, Denver, Colo.
J. W. Spencer, Vice-Chairman, Forest Service, Denver, Colo.
H. D. Cochran, Secretary, Forest Service, Denver, Colo.

Gulf States

E. O. Siecke, Chairman, Agricultural-Mechanical College, College Station, Texas.
V. H. Sonderegger, Secretary, 400 Interstate Bank Bldg., New Orleans, La.

Intermountain

C. L. Forsling, President, Forest Service, Ogden, Utah.
R. E. Gery, Vice-President, Forest Service, Ogden, Utah.
Lyle F. Watts, Secretary-Treasurer, Forest Service, Ogden, Utah.

Minnesota

Henry Schmitz, Chairman, University Farm, St. Paul, Minn.
S. A. Graham, Secretary, University Farm, St. Paul, Minn.

New England

Karl W. Woodward, Chairman, New Hampshire University, Durham, N.H.
H. O. Cook, Secretary, State House, Boston, Mass.

New York

O. M. Porter, Chairman, c/o American Paper & Pulp Association, 18 East 41st St., New York, N.Y.
J. Nelson Spaeth, Secretary, Cornell University, Ithaca, N.Y.

Northern Rocky Mountain

M. H. Wolff, Chairman, Forest Service, Missoula, Mont.
D. S. Olson, Secretary-Treasurer, Forest Service, Missoula, Mont.

North Pacific

C. S. Chapman, Chairman, Weyerhaeuser Timber Co., Tacoma, Wash.
A. H. Hodgson, Secretary-Treasurer, U. S. Forest Service, Portland, Ore.

Ohio Valley

Charles C. Deam, Chairman, Department of Conservation, Indianapolis, Ind.
Burr N. Prentice, Secretary, Purdue University, West Lafayette, Ind.

Southern Appalachian

E. F. McCarthy, Chairman, Room 610, New Medical Bldg., Asheville, N.C.
R. S. Maddox, Vice-Chairman, State Forester, Nashville, Tenn.
F. W. Haasis, Secretary, Appalachian Forest Experiment Station, Asheville, N.C.

Southwestern

Hugh G. Calkins, Vice-Chairman, U. S. Forest Service, Albuquerque, N.M.
Quincy Randles, Secretary, Forest Service, Albuquerque, N.M.

Washington

Arthur Ringland, Chairman, Cosmos Club, Washington, D.C.
E. Morgan Pryse, Secretary Treasurer, Office of Indian Affairs, Washington, D.C.
E. N. Munns, Member of Executive Committee, Forest Service, Washington, D.C.

Wisconsin

C. V. Sweet, Chairman, Forest Products Laboratory, Madison, Wis.
F. G. Wilson, Secretary, Agricultural-Engineering Bldg., University of Wisconsin, Madison, Wis.

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